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The Machinists' Strike—A Fair Interpretation of the New York Agreement.

At this writing the machinists' strike is in full sway and turns out to be a much more serious matter than many supposed it would be. While a number of establishments—some of them of considerable importance—have granted the demands of the men, others, some of them of equal importance, have not granted them and it is declared that they will not do so. In still others no demands have been made or concessions given, while still others have granted the nine-hour day (without reduction of pay) without waiting for a demand to be made.

As was to be expected, a good deal is being said and done on both sides that must be attributed to the excitement incident to the times. Some employers declare that the same question confronts American manufacturers to-day that confronted British manufacturers in 1897 and that nothing will do but to "stamp out unionism and be done with it." This stamping out of unionism has always proven a pretty big contract and it is doubtful if it has ever been done in any establishment without the stamper getting the worst of it in the end. Many of the British manufacturers declared they would stamp it out and tried to do so, but did not, and it is quite certain that such prominent concerns as Harland & Wolfe of Belfast, Tangys of Birmingham, Willans & Robinson of Rugby and Geo. Richards & Co. of Broadheath came out of the affair better for having refused to take part in the stamping-out process.

We do not believe, however, that the case is so serious as this. The men simply believe that the nine-hour is a long enough day and they have gone about getting it, being sustained by the views of many employers who themselves say that nine hours or even eight hours are really enough for a day's work.

But what seems to add more of bitterness to the struggle than any other one feature of it is the charge brought by the Metal Trades Association that the men have violated the "New York agreement" which provided for a nine-hour day at this time, said nothing about wages, but did provide that differences not found possible to settle amicably otherwise should be submitted to arbitration and that there should be no strike or lockout pending their settlement in that manner. On the other hand, though we are not sure that we can say authoritatively just what the men claim, we understand their position to be that a fair interpretation of the New York Agreement is that the nine-hour day was to be granted and that the same wages are to be paid for nine hours as were paid for ten hours. There being this apparently honest difference of opinion as to how the New York Agreement should be interpreted it would seem to be pre-eminently the proper thing to leave its interpretation to disinterested parties, *i. e.*, to let a fairly constituted board of arbitration decide what the interpretation of the New York Agreement should be. Such an interpretation of the instrument having been made, there should be no question whatever as to whether it should be lived up to or not. We are informed that the members of the Metal Trades Association are ready to stand by the agreement and submit the question of wages to arbitration in accordance with the provision made by the agreement; but it seems to us that an arbitration to determine what interpretation shall be put upon the agreement itself ought to be the first thing and that from the nature of the case this should take precedence of all other questions; since it is the primary question on which a difference of opinion really exists.

The machinists dare not take the position that they do not intend to live up to this agreement. If they do they will forfeit all public sympathy and will deserve to lose the fight. They do claim that they wish to live up to it and the employers claim the same thing on their own behalf. Then if both are sincere, the only difficulty that remains is the interpretation of a document, and, as this interpretation is not agreed upon by the contending parties, a disinterested board of arbitration should be chosen to interpret it. If, for instance, Samuel Gompers and Seth Low were to be chosen to represent respectively the men and the employers, they to choose a third man, we believe their decision as to the interpretation of the agreement would be such that neither side could afford to disregard it. It would then be in order for either side to propose amendments to the agreement or to give fair notice of an intention to abrogate it at a future date.

We do not believe that the public has the same right to insist upon a prompt settlement of disputes between employers and employees in such cases as this that it has when cessation of work involves the stoppage of some public function such as carrying on railroad operations, supplying coal, etc., but nevertheless it is to be hoped that a speedy adjustment of the difficulty will be arrived at. We believe that agreements once deliberately made must be lived up to; we believe in arbitration and we believe that nine hours per day are enough for men and boys to be shut up in shops at work.

Mr. Edison's New Storage Battery.

A paper was read by Mr. A. E. Kennelly at the recent annual meeting of the American Institute of Electrical Engineers, in which a storage battery of an entirely new type, the invention of Mr. Edison, was described. The new battery is an important step in the reduction of weight in storage batteries and if extended experience confirms the results so far obtained it can hardly fail to lead to important results in connection with automobile and street-car construction. We take the following particulars from the Mr. Kennelly's paper:

Hardly any success has attended the efforts to reduce the weight of the lead battery during recent years, except by sacrifice of endurance, and this weight is the chief obstacle to the use of the battery for traction purposes.

The weight of the lead battery is from 124.5 to 186.5 pounds per electrical horsepower hour at its terminals, or, expressed in another way, the stored energy, if it

could be utilized without loss, would raise a weight equal to that of the battery a distance from two to three miles.

The weight of Mr. Edison's battery is but 53.3 pounds per electrical horse-power hour at its terminals, or, under the assumption of no loss, it could raise its own weight through a distance of seven miles.

The normal charging and discharging period, to which we judge the above figures apply, is 3½ hours. This period may, however, be reduced to one hour without injury and without loss except a somewhat lowered efficiency. The battery may also be completely discharged without detriment. A cell has, in fact, been not only completely discharged but it has also been recharged in the wrong direction without effect on its storage capacity. These experiments lead to the expectation that the battery will be able to withstand much abuse. Changes of temperature have very little influence and it is expected that the new battery will stand very low temperatures without detriment.

The negative pole, or positive element, corresponding to the zinc of a primary cell, or the spongy lead of a secondary cell, is iron. The positive pole or negative element, corresponding to the carbon of a primary cell, or lead peroxide of a secondary cell, is a superoxide of nickel. The cell is therefore a nickel-iron cell, a name which suggests the structural material—nickel-steel. The electrolyte is potash; viz., an aqueous solution containing from 10 to 40 per cent. by weight, but preferably 20 per cent., of potassium hydroxide, the freezing temperature of which is 20 degrees Fahr. below zero.

The positive and negative plates are mechanically alike, and can scarcely be distinguished by the eye. They differ only in the chemical contents of their pockets. Each plate is formed of a comparatively thin sheet of steel, 0.024 inch in thickness, out of which rectangular holes are stamped, so as to leave a grid or frame somewhat resembling a window-frame.

Each opening or recess is filled with a pocket or shallow box containing the active material. These boxes correspond to the panes of glass in the window-frame analogy. The panes instead of being thinner than the frame, as in an actual window, are thicker than the frame or project slightly beyond the surface of the steel grid. They are perforated with numerous small holes to admit the electrolyte, but entirely conceal the contained active material from view. All that meets the eye, therefore, in any of the plates, is the steel frame, and its embedded "windows" of perforated steel.

The active material is made in the form of rectangular cakes or briquettes, and one such briquette is lodged in each pocket or "window pane" of the plate. Each briquette is in rigid contact with the substance of the plate.

Each briquette is placed in a shallow, closely fitting nickel-plated box of thin perforated crucible steel, cut from a long strip of that material 0.003 inch thick. A cover or lid of the same material is then laid over it, so that the briquette is closely enveloped by the sides and walls of its perforated steel box. The boxes are then placed in the openings or holes in the nickel-plated steel grid and closely fit the same. The assembled plate is then placed in a hydraulic press, and subjected to a total pressure of about 100 tons. This pressure not only tightly closes the boxes, but it also forces their metal sides over the adjacent sides of the recesses in the steel grid, thus clamping the whole mass into a single solid and rigid steel plate with the hollow "window panes" full of active material. The nickel-plating of both grids and boxes aids in securing good permanent electric connections between them. The finished plate has a grid thickness of 0.024 inch, and a "window" or pocket thickness of 0.1 inch. This is the maximum thickness of the plate at any point, but being of steel, the plate has ample rigidity.

The positive briquettes (zincs of a primary cell) are made by mixing a finely divided compound of iron obtained by a special chemical process with a nearly equal volume of thin flakes of graphite. The graphite does not enter into any of the chemical actions, but assists the conductivity of the briquettes. The graphite is divided into very thin laminæ by a chemical process, and these are passed through sieves or screens so as to leave a size or area of flake that is much larger than the area of the perforation in the steel windows. The mixture is then pressed into briquettes in a mold, under a hydraulic pressure of about two tons per square inch. The briquettes have a surface area of nearly 3x½ inch on each face.

The negative briquette (carbon of a primary cell) are made by similarly mixing a finely divided compound of nickel, obtained by special chemical means, with a nearly equal bulk of fine flakes of graphite, and solidifying the mixture in a mold into briquettes of the same size as above.

A suitable number of positive and negative plates are assembled together, being separated from one another only by a thin sheet of perforated hard rubber.

The assembled plates are placed in a vessel or external containing cell of sheet steel containing the potash solution, which, of course, does not attack steel. There was, however, much difficulty from the action of the potash on the soldered seams of the steel-containing vessel. After many trials, however, Mr. Edison found a solder which seems to be entirely unaffected by the alkali.

American Guarantees for Foreign Patentees.

Recent interviews with officials of the British Patent Office, as reported in the London "News," give us some interesting reading, and bring out quite clearly the features of the British system as different from our own.

"Yes," said the first official, "in this country a person takes out a patent at his own risk. We register the date of his application, and we keep a record of his invention—for the rest, if any dispute arises, a court of law must settle it."

"Does this system give general satisfaction?"

"No. Many persons are anxious that an English patent, like an American patent, should carry with it a guarantee of novelty. A recent Board of Trade committee favored such an investigation as would yield an assurance that the invention has not been previously patented in this country during the fifty years preceding the application."

"What applications do you refuse under the existing system?"

"Only such as propose to accomplish ends that are frivolous, immoral or contrary to law. They represent only an infinite-imal fraction of the applications, which come in, you know, at about the rate of 100 per working day."

"And is the number increasing?"

"No. The last three years have witnessed a falling off, owing partly to the war, but mainly, I think, to the end of the great boom in cycling inventions."

"Then, did no new subject crop up to take the place of cycling?"

"Well, nothing that bulked so largely; but of course there is usually some special subject to the fore. Thus, our last year's report testified to much activity in penny-in-the-slot machines, and while there was a distinct falling off in galvanic batteries, there was much activity in seats for shop assistants. Sunshades for horses' heads made us busy in the summer."

"And now, I suppose, your attention is largely occupied with instruments of war?"

"No; curiously enough, that is not so."

Another official talked as follows:

"In France and in many other countries, including Canada, Victoria and Queensland, no assurance is implied that a patent has not been anticipated. The only two countries in which a thorough examination is attempted to be made are the United States and Germany. In the United States an examination is made, not only of the American specifications, but also of the specifications of all other countries. Also the scrutiny is extended to general scientific literature."

"Does perpetual motion continue to be constantly discovered?" I ventured to inquire.

"Yes," came the smiling reply. "We still do a steady business in perpetual motion; only, you know, in our records we don't call it by that name. We tone it down to 'motors, self-driving.' We patent perpetual motion about twelve times a year."

"And how do flying machines stand?"

"About two dozen a year—in 1893, for instance, the number was twenty-six."

"By the way, how does the Patent Office of the United States handle perpetual motion and flying machines?"

"Well," came the sufficient reply, "the Patent Office of the United States enjoys the right of demanding to see a working model."

Two suggestions naturally follow from the above. The inventors of perpetual motions, and other impracticable and impossible devices, should make all haste to take out British patents. Such patents are not likely to hurt anyone and may afford some consolation to the inventors.

But we suggest in all seriousness that in many cases it should be a good plan for British and other foreign inventors to obtain, when possible, United States patents upon their inventions, even though there may be no prospect of selling the American patent or patent rights under it. It is not strictly true that the American Patent Office *guarantees* the novelty of every or of any invention for which a patent issues. It does, however, make a tolerably thorough examination of all previously published records of inventions, and if no anticipating device is found, the patent issues. The patent therefore carries with it a strong presumption of novelty, which the British patent does not, and the British patentee with an American patent in addition is evidently more strongly fortified at home than if he rested upon his British patent alone. The American fees are low, and the presumption of novelty which an American patent carries is cheaply bought, even if only for the moral effect in Great Britain, and when the possible realization of profit in America for any invention of considerable intrinsic value is added, the paying of the United States fees would seem to be a highly promising investment. When foreign inventors realize this we may expect to see them seeking American patents in greater numbers. Indeed, this mode of obtaining guarantees of presumptive novelty would seem to be cheaper and perhaps every way as satisfactory as could be found in any change in the British Patent Office practice.

"The Engineer" on Anthracite Coal.

In reviewing Mr. Kent's book on Steam Boiler Economy "The [London] Engineer," in its issue of May 10, includes this curious sentence: "A good deal of space is devoted to furnaces for anthracite, with which, thanks to a beneficent Providence, English engineers have nothing to do." This can only be interpreted as meaning that in the writer's opinion anthracite is an inferior fuel. It may enlighten him some to be told that in this vicinity it commands, roughly speaking, nearly double the price of bituminous coal; that because of its merits its use in this city is practically compulsory; that it is only its lower cost that leads bituminous coal to be used at all for general manufacturing; that where anthracite can be had at double the price it is exclusively used for domestic purposes; that the necessary use of bituminous coal in the West is a misfortune so great as to almost deserve being called a curse to that region; that anthracite is absolutely smokeless and, compared with soft coal, cleanly in handling; that on its merits and apart from price soft coal is not in the race with it, and that, in short, it is the nearest approach to perfection in solid fuel which this world affords.

The writer of the notice accuses Mr. Kent of ignorance, but with this indication of the extent of his own knowledge, we doubt if Mr. Kent will lose any sleep over the accusation.

Commercial Review.

NEW YORK, Monday, May 27.

ENGINE MARKET AND OTHER MACHINERY NOTES.

This spring's demand for steam engines of the slow-speed type has proved excellent and sellers are frequently ready to admit that it exceeds the trade of a year year ago. Factories are in some instances more than comfortably crowded with work. The demand comes from manufacturing as well as the electrical lines, showing a continued expansion of the country's industries.

High-speed engine builders, or at least those who have a good foothold on the market, are also getting lots of work. Local building operations are looking especially bright. In the lower part of the city the numerous old buildings on leading thoroughfares that are now in process of demolition give ocular evidence of the new office structures that are eventually to occupy their places and call for isolated plants. Uptown there are to be several new department stores and important hotel installations are also to be reckoned with.

The isolated plant engine trade is subject to its peculiar vicissitudes. For one thing it meets a damaging competition from street current electric companies. The latter, it is asserted, will sometimes make very low rates to prevent the installation of a private plant by a large user of current, being compelled to make it up by charging a good deal to the smaller consumers. Moreover the urban engine seller has to keep his wits about him or he will be in constant risk of losses through chicanery of unscrupulous customers, through trusting to second-mortgage bonds, through embarrassing clauses in the contracts he signs or through stipulations of the general contractor to which he is not a party. There is also a difficulty in thawing out the frigidity of architects and engineers especially if it is to be done without influence and on behalf of an engine which has not acquired a thorough recognition in the locality. Particular makes of engines prevail in the installations of particular cities. One make, for instance, is pointed out as having the call in Philadelphia, another in Boston, while the names of several engines are mentioned that are frequently installed in New York.

One of the most important contracts given out for the equipment of the works of the British Westinghouse Electric & Manufacturing Company was received by the Cincinnati Milling Machine Company. It comprised the entire equipment of plain and universal milling machines and universal cutter and tool grinders, and comprised more than 60 machines in all. The order was taken in face of the strongest competition, American and foreign. The Cincinnati company considers it the largest order for this class of machines ever placed at one time.

There has been a good deal of current uncertainty whether the Lodge & Shipley Machine Tool Company, of Cincinnati, did or did not receive a large order for lathes for the British Westinghouse works. We can now settle the question in the affirmative. The order calls for ninety-five engine lathes of 18 to 24 inches swing. Eleven planers were ordered from the G. A. Gray Company.

Cincinnati has therefore come out of the affair with flying colors and credit is due not only to the three manufacturers named but to their representatives, the Brown & Zortman Machinery Company, of Pittsburgh, who have been working since about December 1 last to secure the deal.

Pratt & Whitney Company are going to carry a large stock covering their entire line of tools at a space in the exhibition department of the Philadelphia Bourse, where J. W. Cregar, who formerly had charge of the New York office, will represent them, as we stated on page 191. Among other connections Mr. Cregar is the Philadelphia representative of the Hendey Machine Company, Torrington, Conn., carrying a full line of lathes, shapers and milling machines; of Fosdick & Holloway Machine Tool Co., Cincinnati; of Bignall & Keeler Manufacturing Company, Edwardsville, Ill.; of Baker Bros., Toledo, Ohio; of R. K. LeBlond Machine Tool Company and Bradford Machine Tool Company, Cincinnati. A sample of each machine will be carried in the exhibition space, and arrangements are being made so that each may be shown in action. The selection of machine tools handled by Mr. Cregar will constitute the largest single exhibition of this kind in Philadelphia.

Hill, Clarke & Co., of Boston, have placed a stock of new Brainard milling machines on the market at cut prices.

The New York Central has just awarded the contracts for the 2,000,000-bushel Weehawken grain elevator, which, it is said, will be larger than any now in existence. The cost will be nearly $1,500,000. The contract for the superstructure was

given to George M. Moulton & Co., of Chicago. The sub-contracts for the machinery are not yet entirely closed, although it is understood that they have been pretty generally arranged for informally. We expect to be able to make an announcement in this particular in our next issue.

The imports of machinery into Germany for the first quarter of the present year amounted to 15,598 tons, as compared with 20,317 tons for the corresponding portion of last year. Of this amount, machine tools were but 557 tons, or little more than a quarter of the amount during January, February and March, 1900, which was 2,032 tons. German exports of machinery for the first three months of 1901 were 50,490 tons, against 56,111 tons a year previous, showing a relatively smaller decrease than the imports. Machine tools exported were 2,901 tons for the first quarter of this year, against 2,204 tons the first three months of 1900. Consequently Germany has this year exported about four times as large a quantity of machine tools as she has imported.

A gleam of hope for American manufacturers comes from Berlin in a report from Consul-General Frank H. Mason.

"It is one of the anomalies of the present situation in Germany," he writes, "that notwithstanding dull and declining home and foreign markets for most products of German manufacture, there is an unusually brisk and insistent demand for certain articles of American origin. During no recent period have so many inquiries, personal and by letter, been received at this consulate from German firms and individuals who wish to be put into direct relations with American manufacturers and exporters, as during the first three months of the current year. These inquiries cover a large range of merchandise, including small machinery of many kinds, typewriters, time and cash registers, furniture and office supplies, shoes, leather, lumber, and even dress goods and other textiles of wool and cotton which, surprising as it may seem, are now produced in the United States under conditions which, it is believed here, will warrant their export to European countries. . . . . .

"While it is probable that the imports of American machine tools, electrical and even agricultural machinery, may show a marked decline during the current year, as compared with 1900 and 1899, there is yet an unsatisfied demand for a wide range of novelties and special inventions in which American ingenuity and adroitness in manufacture have produced something strikingly superior to what is known or used in this country.

"As an indication of what is meant may be cited the recent inquiry of a leading importing firm at Berlin, which solicits information and propositions from makers of the most modern and highly improved centrifugal machinery for chemical and laundry purposes, filling machines for charging small paper bags with groceries and medical preparations, filling bottles with salts, etc., and machinery for making pastilles and lozenges of all kinds. It is well known that in these and many other specialties, though not in all, American machinery is unequaled; but there is a lack of means for obtaining here exact knowledge, not only of the latest improvements, but of their weight and cost. Dealers with experience, ample resources, and knowledge of the German market are numerous and ready; it is the American salesman with samples and specifications who is generally lacking."

A recent consular report shows that the direct imports of machines and apparatus of pig iron, iron and steel into Russia from the United States in 1900 amounted to 2,040,000 pounds, valued at $229,690. Of course a large quantity of machinery besides this must have reached Russia from here indirectly, being first exported to Germany.

CHICAGO MACHINERY MARKET.

Without exception Western representatives of electrical machinery builders report a brisk inquiry. There is not an equal distribution of business, for prices are not all of a kind, the disparity in some instances reaching fifteen or more per cent. From all accounts the builders are crowded with work. A large Chicago packer, wishing to procure a dynamo of special voltage to furnish lights for a miniature exhibit at the Buffalo Exposition, made the rounds among salesmen here and offered all kinds of premiums but could not obtain delivery within sixty days. The electrical people are so busy with the regular run of orders that immediate time can not be spared for special work.

There has been large buying during the past month. The railroad work is prominent. The Lake Shore has bought from the Crocker-Wheeler Electric Company one 400 and one 75-kilowatt generator for the new Collinwood shops and ordered two Buckeye engines of about 600 and 125 horse-power respectively. The company will buy another 400-k.w. generator in about a year, and in the construction of the plant space is left for still a third generator of like power. The Chicago, Burlington & Quincy road has bought from the Crocker-Wheeler Company a 150-kilowatt generator for the Hannibal shops—the fourth and last generator of the series, and has also purchased a Westinghouse engine of about 225 horse-power. The St. Louis, Iron Mountain & Southern has inquiries out for three 125-kilowatt generators and for ten or fifteen large motors for new shops. The Michigan Central has deferred the purchase of an electrical shop equipment for a year or two.

Shops are buying equipment actively. The L. Wolff Manufacturing Company, Chicago, bought a 250-kilowatt generator and motors to correspond from the Northern Electrical Manufacturing Company. The Christensen Engineering Company, Milwaukee, bought an Allis engine and a 400-kilowatt Crocker-Wheeler generator. This purchaser has its output of electrical air brakes sold a year ahead and will manufacture its own motors. William B. Pollock & Co., Youngstown, Ohio, have bought from the General Electric Company a 300 horse-power generator with corresponding motors. William J. Moxley & Co., Chicago, have bought from the Western Electric Company a 400 horse-power generator. Armour & Co. have bought for New Orleans installation one 100 and one 25-kilowatt generator. The Geuder & Paeschke Manufacturing Company, Milwaukee, have bought another 150-kilowatt generator from the Sprague Electric Company. James Leffel & Co., Springfield, Ohio, have installed a 100-kilowatt generator. Kohler Bros. will equip the Pittsburgh "Commercial Gazette" office with twenty-one motors and a complete wiring. The Stirling (Boiler) Company, Barberton, Ohio, will put in an electrical equipment.

For all kinds of electrical supplies, business is booming. Many Western railways are rapidly equipping their entire lines with extensive telephone systems and demand for other lines of apparatus is equally active.

Quotations.

NEW YORK, Monday, May 27.

Pennsylvania Foundry Pig Irons, Jersey City delivery, good brands:

No. 1 X	$15 65 @ $16 25
No. 2 X	15 15 @ 15 25
No. 2 plain	14 25 @ 14 50
Gray forge	14 00 @ 14 25

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 50 @ 15 75
No. 2 foundry, or soft	15 00 @ 15 25
No. 3 foundry	14 50 @ 14 75
Foundry forge, or No. 4	14 25 @ 14 50

Bar Iron—Base sizes—Refined brands, mill prices on dock, 1.55 @ 1.65c.; from store, 1.80 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 1.90 @ 2.00c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper in carload lots—Lake Superior ingot, 17c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c.

Pig Tin—28½ @ 28¾c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.00 @ 4.05c., New York.

Antimony—Hallett's, 8¾c.; Hungarian and Italian, 8⅝c.

Lard Oil—Prime City in jobbing lots, 65 @ 67c.

A Modern German Machine-Tool Shop, the Deutsche Niles-Werkzeugmaschinen-Fabrik—III.

THE MACHINE SHOPS.

Incidentally we mentioned last week some of the features of the machine shops, and we now enter upon a more detailed description of them.

From the base of the staircase a view from the front end of the first aisle, as shown by Fig. 26, is had. A central row of iron columns, clothed to make them fire-resisting, supports the gallery above and divides the aisle into two; the upper end of the outer part is devoted to the various gear cutters for spur, bevel and worm wheels. Here, as elsewhere, there is at present plenty of space to accommodate machines that are to be placed later; on the plans these machines are already located, so that no confusion, crowding or moving will be necessary when they come. Two lines of shafting are carried along the ceiling about the same distance on each side of the central row of columns.

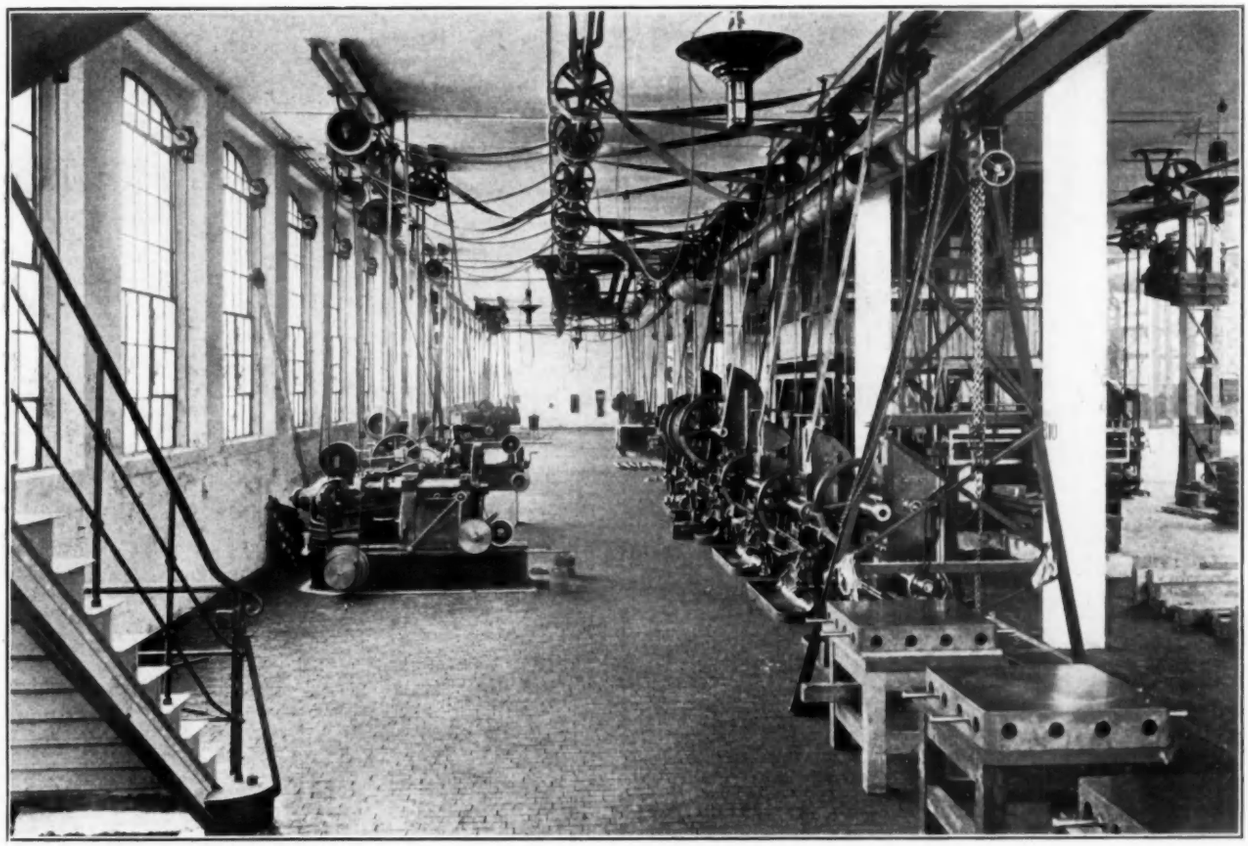


FIG. 26. VIEW OF THAT PORTION OF MACHINE SHOP DEVOTED TO GEAR CUTTING. STAIRWAY AT LEFT LEADS TO POWER PLANT.

The hangers as well as the channel-beam stringers carrying the counters are clamped to the lower flanges of the I-beams supporting the gallery floor. As these beams run transversely to the aisle it is a very convenient matter to clamp counter-stringers wherever may best suit the machines. A smooth, light gray calcimine serves admirably to distribute the light from the inverted arc lamps, one of which is plainly visible in the foreground. About midway of the length of the aisle the shafting is divided into two independent parts, each geared into its separate motor also hung from the ceiling. The frames carrying these motors are quite plainly visible on Fig. 26. The mass of the solid ceiling is found quite sufficient to absorb the slight vibrations from the motors, so that universal grinders on the upper gallery, placed near the wall, give no evidence of trembling. Partially concealed by the bank of gear cutters, a tool-distributing room will be seen, whose upper story is occupied by the foreman and his clerk. From this elevated position a good view of the entire department may be had. Similar tool and foremen's room are placed throughout the shop.

Fig. 27 is a view from the lower end of the manufacturing erecting aisle. Its construction is typical for the rest of the shop. The width from center to center of crane columns is 50 feet; the length, 200 feet. Hight from floor to top of crane rail is 25 feet; to lower edge of roof truss, 32 feet 6 inches. The outer light wooden roof has an inclination of 1 in 2, which is found to afford a good hold for the wood-tar paper covered and graveled roof under such heat as the summer sun develops in that climate. The central portion, of clear wire glass, has a pitch of 1 in 1¼; experience in this rather moist climate has shown that with a lesser inclination the condensed moisture is not carried off by the channels provided in the framing, but drops down into the shop. Centrally hung, and therefore balanced, shutters along the whole length of the two sides of the louvres at the apex, conveniently controlled from the shop, provide for ventilation as needed. Rain water and melted snow collecting in the valleys between the roof are carried off by drain pipes at every other crane column into gullies laid well below the shop floor. The roof itself is slightly waved in the direction of its length to drain toward these pipes; an inclination so slight as to be unnoticeable from within is quite sufficient. The crane columns are of light lattice work, with the web of the channel beams placed outward to give a smooth surface for attaching things. They are 20 feet from center to center. The crane girders are of various weights to suit the capacity of the cranes; those for the heavier cranes are trussed on the bottom to save material. This in Germany is found more economical than to make the lower member continuous, as the labor involved costs less than the material saved. The piping for the hot air heating and ventilating system is carried on the lower stringer of the roof trusses.

The line shafting is generally hung well up to the under sides of the crane girders between the columns, as may be clearly

seen in Fig. 27, and carried on wall brackets bolted to the inner side of the channel-beam crane column members. It is divided up into short lengths, each driven by its own individual geared motor, that is placed on brackets clamped to the crane columns (see Fig. 27, about the center of each side).

The general illumination is taken care of by direct arc lamps hung just clear of the traveling cranes between each roof truss. In order to determine their best position, a portion of the lamps were also hung lower and between the columns, from the crane girders; but it was found that the method finally adopted gave a much more even distribution of light, with almost no shadows. The quality of the daytime light is sufficiently evident from a consideration of the photographs, most of which were taken during the noon hour of rather dull November days in the high latitude of Berlin—52° 30'.

An agreeable shade of green gray applied to all of the structural work, with the exception of the bases of the columns (that are painted black, so they will not show oil stains and finger-marks), contributes not a little to this even distribution of light and also accentuates the grace of the whole structure. One is at first rather surprised to find that it is amply strong for two 30-ton cranes on the same track. There are five aisles side by side, all like the one described, and two side aisles of the same dimensions with galleries. These all give into an erecting aisle running transversely to them, 60 feet wide and 350 feet long, with a clear hight to the crane tracks of 28.5 feet and of 36 feet to the roof-stringer. The whole ground floor area of the machine shop is therefore $350 \times 260 = 91{,}000$, to which must be added $200 \times 100 = 20{,}000$ square feet of gallery flooring, making 111,000 square feet in all.

The third aisle (the first one that is continued to form the foundry) is shown by Fig. 28 as seen from near the lower end, and by Fig. 29 as viewed from the erecting aisle down to the end of the foundry. One side is given up to boring and turning mills, the other to planers, all within convenient reach of the two 20-ton cranes traversing this aisle. To the left of Fig. 29 one of the methods for driving from line shaft to counters, and from these to the machines can be seen. Two horizontal channel beams are carried from column to column, well braced by lighter channel beam struts and gaspipe distance pieces with tiebolts. Light cast-iron wall brackets carry the usual countershaft furnished with the machine, and are clamped to these girders. In a few instances, where exceptionally heavy driving or long overhang required it, a second similar girder was placed on the opposite side of the crane column, and connected to the first by transverse top and bottom channel beams; the whole making a very stiff latticed box that cuts off very little light.

The next aisle, Fig. 30, as seen looking toward the erecting aisle, is given up to heavy planers served by two 20-ton cranes. The planer on the left is 12x10x30 feet. At first glance one would be perhaps not inclined to credit it with the great power it really possesses. An observation of the absolute steadiness with which it will take a cut ¾ inch deep and 3-32 inch feed on each of four tools without jar on entering and leaving the cut sufficient to upset a full-length leadpencil set on end, soon leads to a reversal of this first impression, assisted by consideration of the fact that its table (cast in a single piece) alone represents a weight of 40 long tons.

Fig. 31 was taken with the camera placed in the next aisle, pointing toward the front, and takes in half the width of this aisle, which is given up to light planing, slotting and shaping machines. Next to the track, that crosses the aisle at about the middle of its length, is a tool-distributing room, with foremen's and clerks' enclosure above it. As the machines are of medium size, it was possible to arrange two rows down the center and to drive these from a line shaft carried on the columns shown at the right of the picture. The two 10-ton cranes can pass over this central line shaft without interference, and so serve all of the tools in the aisle.

From the view of the lathe room, as seen in the front of Fig. 32, a better idea may be gathered of the arrangement original with the designer of this plant, of

FIG. 27. VIEW IN AISLE FOR ERECTING TOOLS MANUFACTURED IN LARGE NUMBERS.

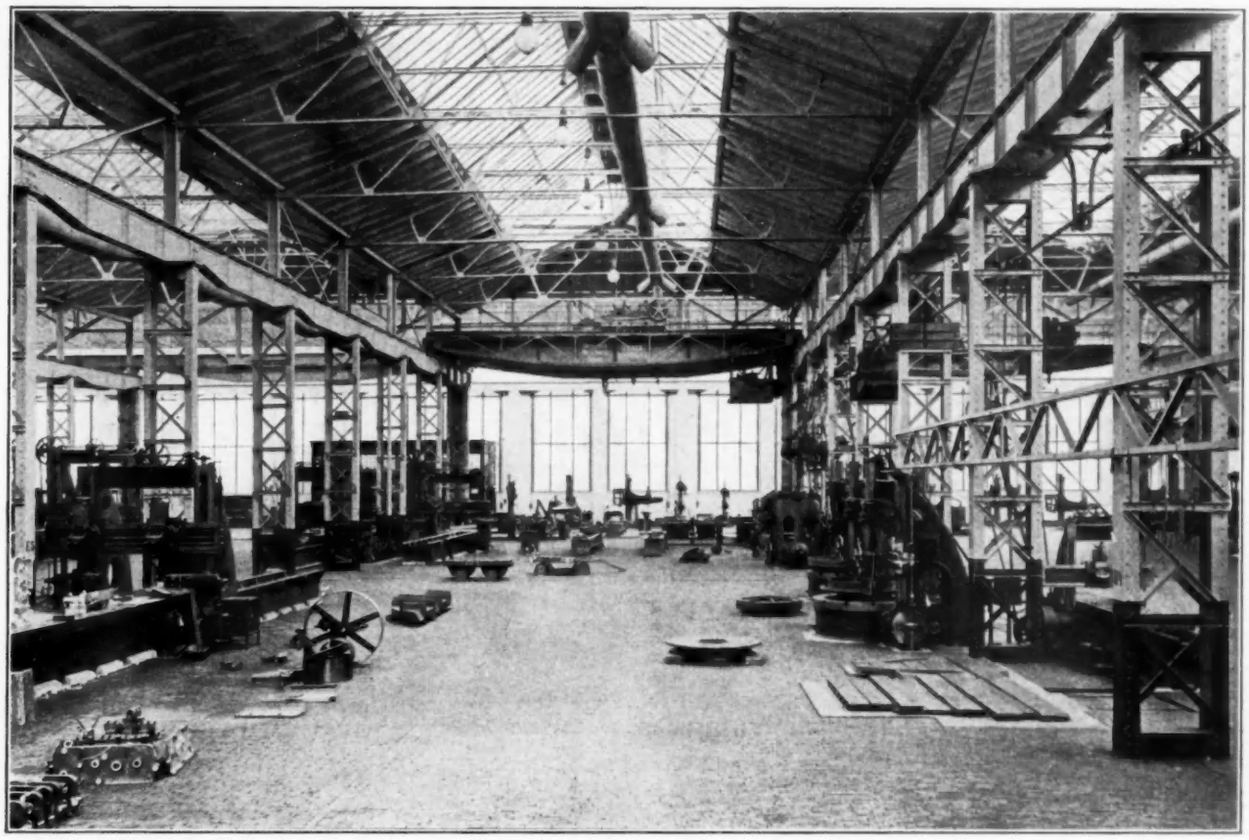


FIG. 28. VIEW IN THIRD AISLE OF MACHINE SHOP, LOOKING TOWARD ERECTING AISLE.

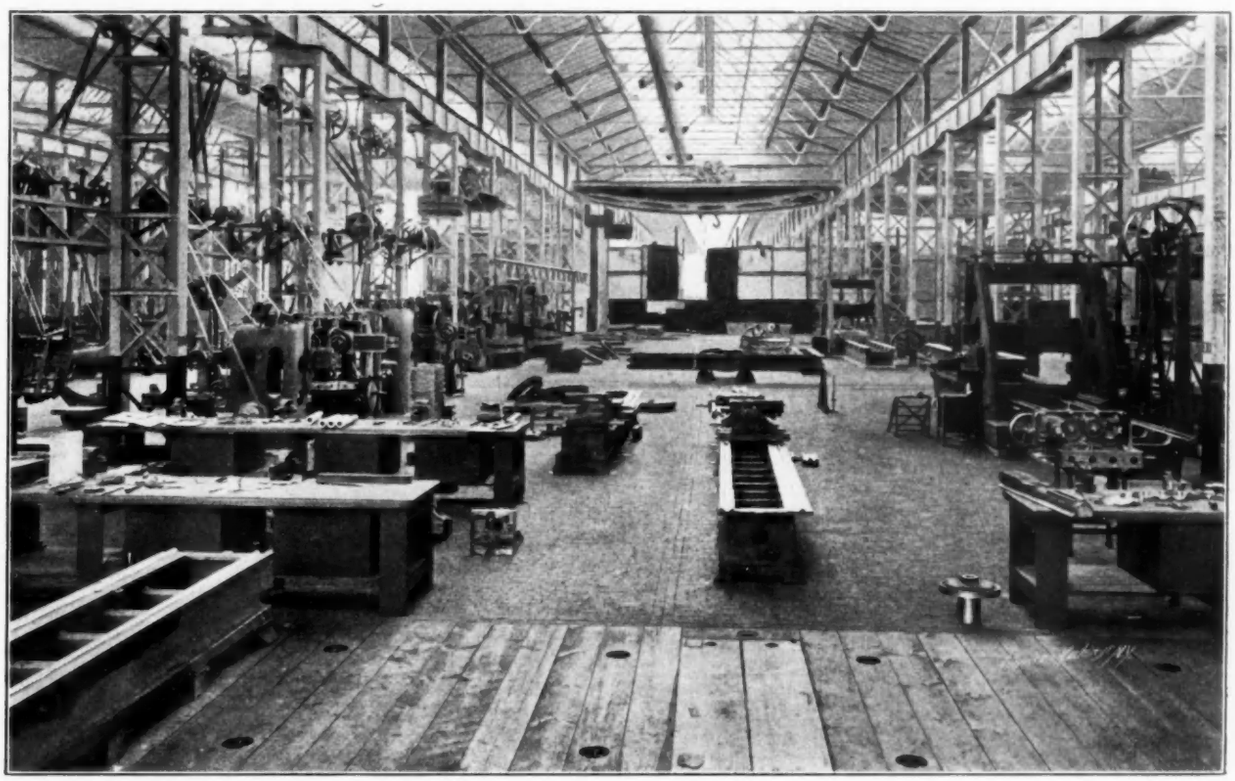


FIG. 29. VIEW IN THIRD AISLE OF MACHINE SHOP, LOOKING TOWARD FOUNDRY.

one or more intermediate lines of shafting and countershafting arranged in such a way as to permit their being traversed without interference by overhead cranes. A row of cast-iron columns with liberal bases is secured to light foundations. The line shaft is placed on the top of these columns. At about two-thirds of their hight double channel- or H-beams are bolted to brackets cast to the columns. Light cast-iron brackets are bolted to planed faces on the sides; at their outer ends I-beams are clamped. Transverse channel beams clamped at pleasure to the longitudinal I- and H-beams give a good base for clamping the usual countershaft hangers, and at the same time act as transverse stiffeners for the whole structure.

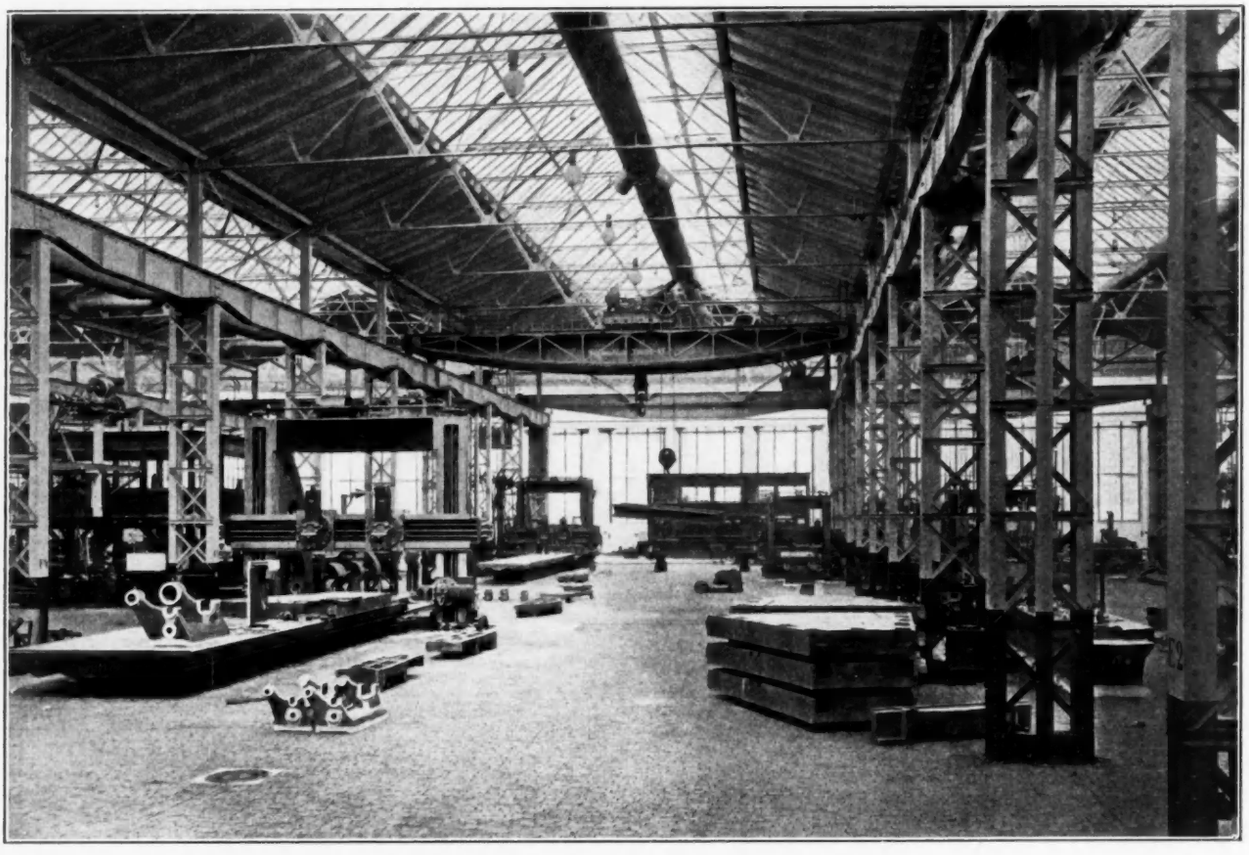


FIG. 30. VIEW OF AISLE FOR HEAVY PLANERS.

The bending moments are very small, as the angle of the belts from the line to the counters is not large, while the power taken off on opposite sides is nearly the same; the belts reaching from the centers to the machines run very nearly vertically, and as here, too, nearly equal power is delivered on both sides, the bending stresses are practically balanced.

The forward end of the next aisle is devoted to pulley machinery and countershafting, while the rear end, Fig. 33, accommodates the grinding machines on which all round fits are finished. Still farther along are the screw lathes. This is the last aisle. Over it there is a gallery devoted to the making up of tools for all that part of the plant not given up to building machines in larger lots. This part has its own tool-making room, as previously described. On this gallery is also located a small corps of draftsmen, who design the various shop tools and fixtures.

ERECTING FLOOR, BOXING AND SHIPPING.

As previously mentioned, all of these aisles give into the erecting aisle of Figs. 34 and 35, as seen from the 20-ton cranes from opposite ends. A siding of the main track traverses these aisles. Ranged along the wall are the various vertical and radial drills, all with individual motor drive. On the shop side of the track at the upper end are three floor boring and milling machines, also individually driven. The opposite end, from which all shipments are made, is given over to the shop carpenter and shipper, and the wood-working machines needed by him. About the middle of the wall there is a commodious tool and drawing distribution room, the upper glassed-in portion of which is occupied by the head foreman, erecting foreman and the clerk who keeps track of the run of work between the various departments, and sees to it that work is carried through in the time planned.

ERECTING PIT.

Between the tracks, close up to the ends of the longitudinal aisles and extending across the width of three of them, there is an erecting pit, 200 feet long by 16 feet wide by 8 feet deep for the first half of its length, and half that depth for the remainder. This pit, partly uncovered, is best seen in Fig. 34. Planed cast-iron rails of box section are well secured on top of the side walls. At intervals of 8 feet there is permanently set in the cemented bottom a series of planed soleplates to receive substantial truncated pyramidal columns with planed tops, on which in turn longitudinal planed cast box girders are laid. A series of transverse girders can be distributed as needed; these serve as parallel blocking, always ready leveled, for the erection of such machines as boring mills, planers, etc. A few girders, long enough to reach across the full width of the pit, are provided for especially large machines. Such portion of the pit as is not in use is covered level with the top of the transverse girders and the floor by 4x8-foot sections of heavy planking.

Future enlargement of the machine shop will be made by the addition of longitudinal aisles and the extension of the transverse erecting aisle toward the west. The foundry can be extended two bays east, and westward by as many more as are ever likely to be wanted. Plenty of room for a westward extension of the brass foundry is available. The rearward extension of the office building is already laid down on paper; it will accommodate the drafting room whenever an expansion

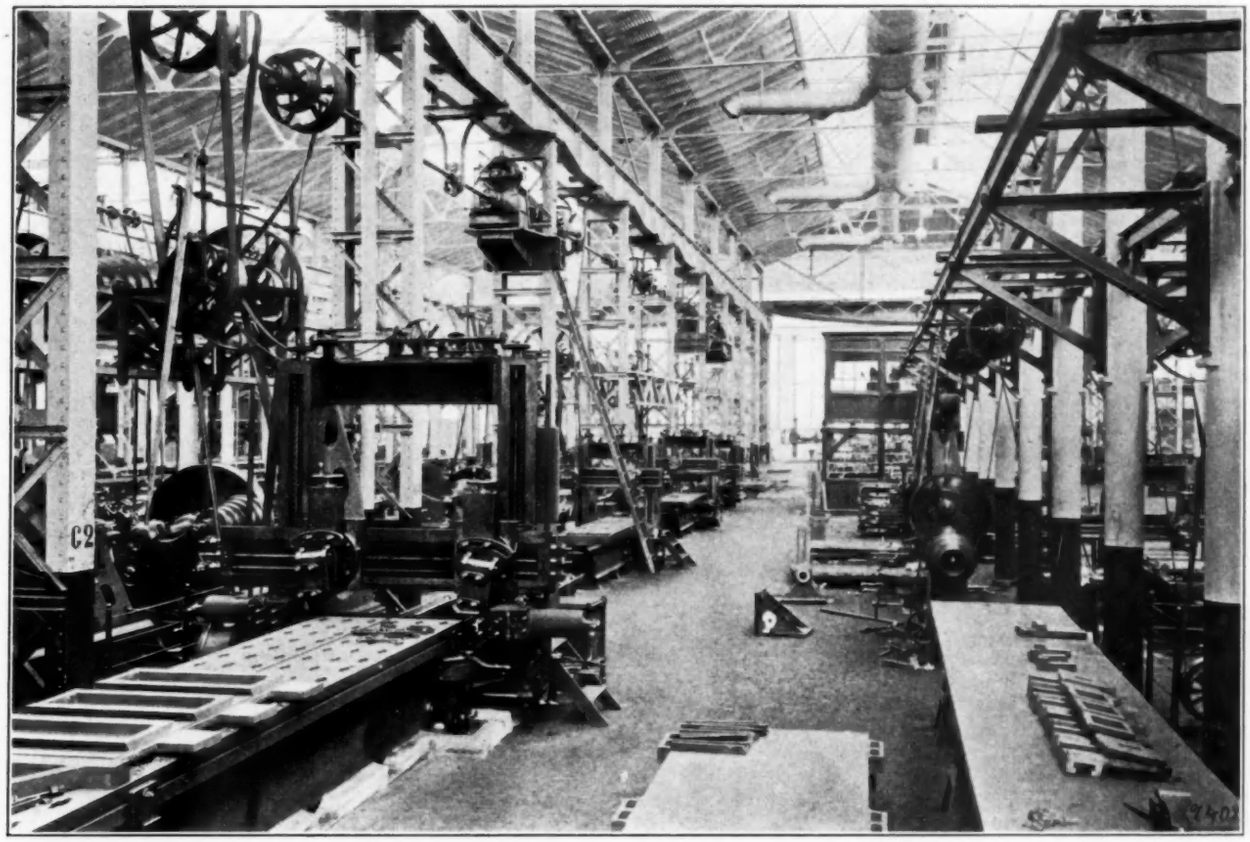


FIG. 31. HALF THE WIDTH OF THE AISLE DEVOTED TO LIGHTER PLANERS, ETC. FOREMAN'S OFFICE AND TOOL-DISTRIBUTING ROOM. LINE SHAFT UNDER TRAVELING CRANE.

FIG. 32. LATHE ROOM. COVER OF ERECTING PITS IN FOREGROUND.

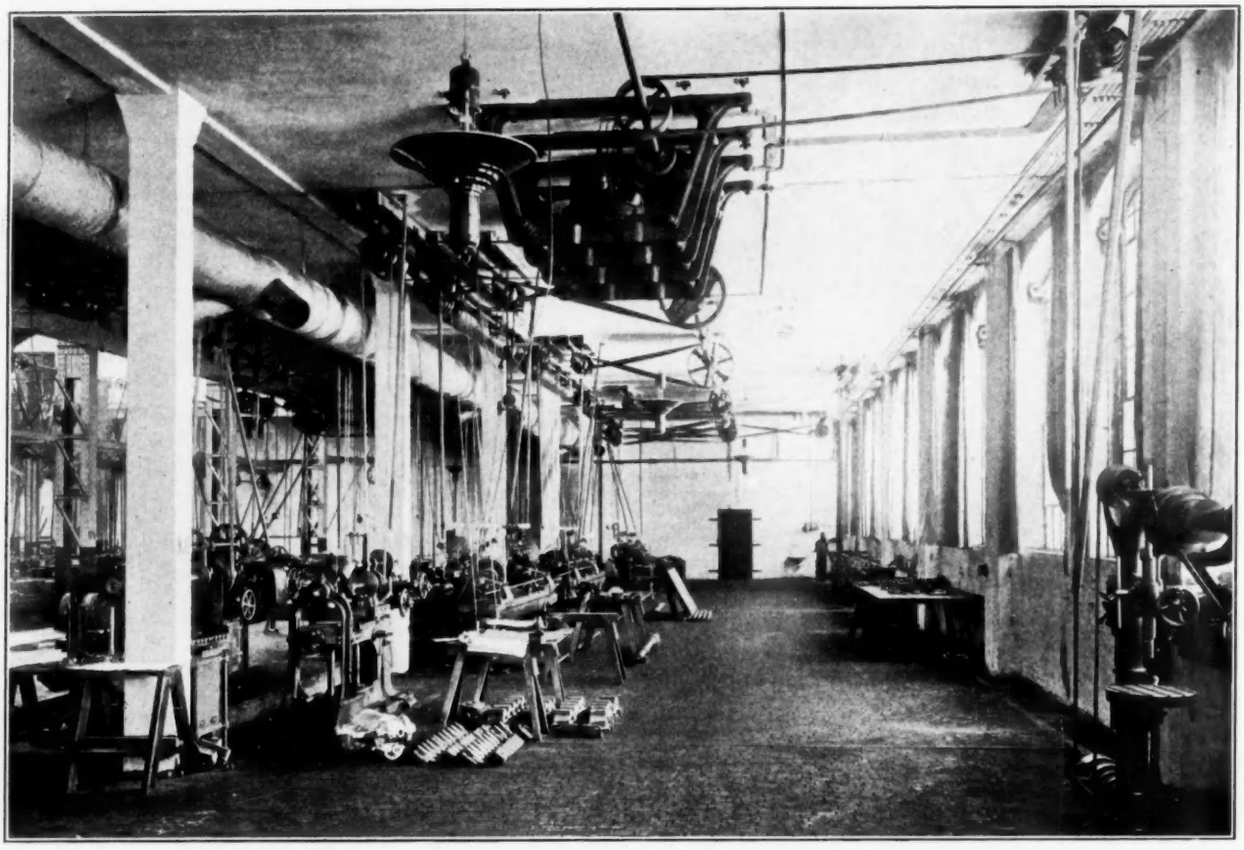


FIG. 33. AISLE DEVOTED TO MANUFACTURING COUNTERSHAFTS AND TO GRINDERS FOR FINISHING BEARINGS.

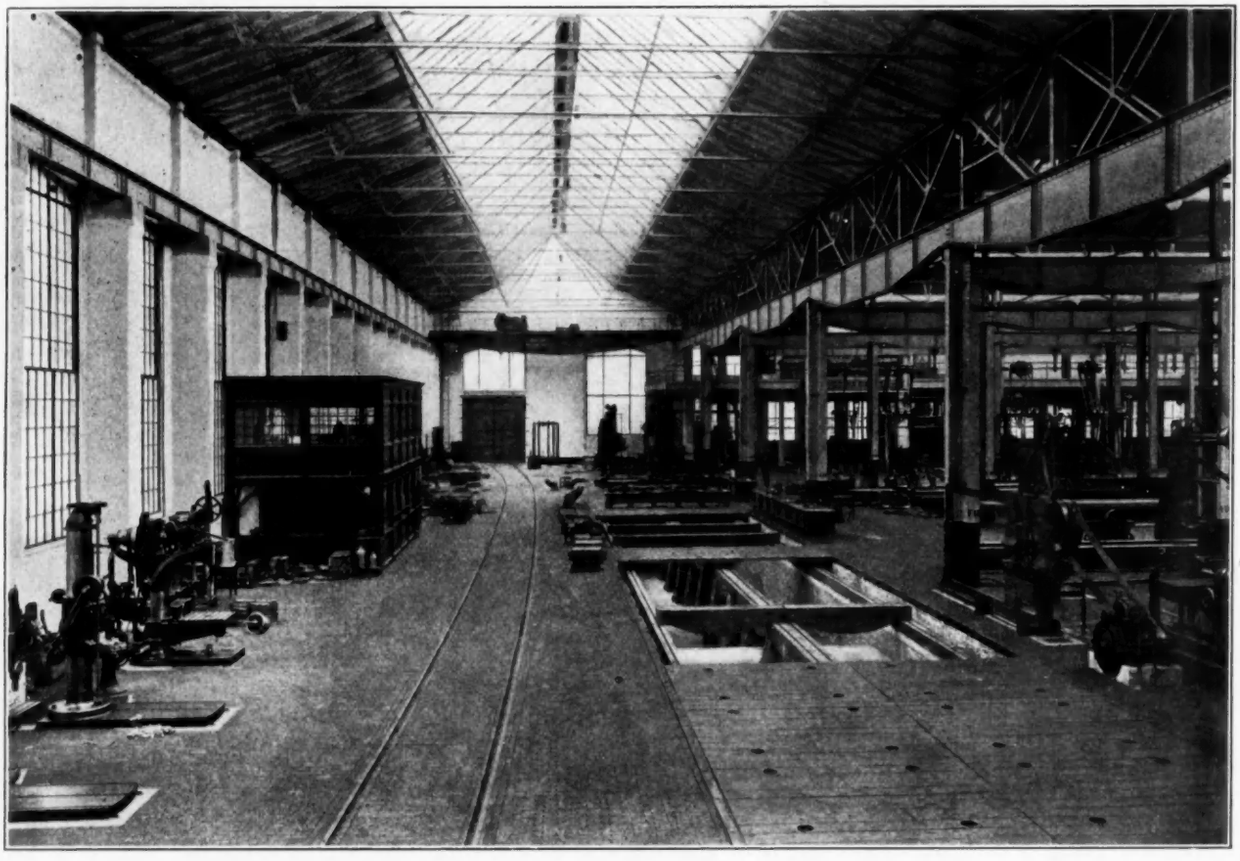


FIG. 34. VIEW IN ERECTING AISLE. ERECTING PITS AT RIGHT. STANDARD GAGE RAILWAY TRACK THROUGH CENTER.

of the pattern shop to take in the present drafting room shall indicate the advisability of this measure. Such structural work as is needed in the walls toward the sides to be extended is already built in. As previously mentioned, the remaining buildings are at present sufficient for the needs of the ultimate enlarged plant.

A comprehensive, carefully laid out system of underground sewers takes care of all storm and other waters. An abundant supply of water from the public mains, under a good head, serves for drinking and fire fighting; stand pipes and hose are liberally distributed throughout the buildings, and in combination with a portable hose cart and street hydrants conveniently placed, together with the practically fire-proof character of the buildings, reduce serious damage by fire to a very remote probability. An equipment of machines and small tools, the best of their kind, supplied by the foremost makers of two continents, a technical management of wide experience in the building of heavy machine tools and kindred industries, a business management of acknowledged high repute in similar lines, as well as an earnest intention to keep the product always well in the lead of the highest standard of excellence, certainly promise well for the future of the concern, and it is evident that the most advanced ideas have prevailed in the planning and construction of the plant.

A large number of interesting features as to details of fixtures, methods and appliances had of necessity to be disregarded in this description, but will be described from time to time.

We are informed that visitors are at all times cordially welcomed and given the entire freedom of the works.

Astronomical Engineering Work.

In the presidential address of William H. Maw, delivered before the Institute of Mechanical Engineers in London April 19, he touched upon the astronomer's demands upon the mechanical engineer in an interesting way, as follows:

Even astronomy has helped him [the engineer] indirectly by putting before him problems of construction only capable of being solved by an accuracy of workmanship which would possibly be otherwise uncalled for. Thus the dividing machines constructed for the graduation of certain astronomical instruments, constitute probably the nearest approach to absolute perfection in machine work which has yet been attained. For instance, the most recently constructed machine of the kind of which I am aware—namely, one made by Messrs. Warner & Swasey, of Cleveland, U. S. A.—is capable of automatically cutting the graduations of a circle with an error in position not exceeding one second of arc. This means that on a 20-inch circle the error in position of any one graduation shall not exceed 1-20000 inch. Now, the finest line which would be of any service for reading purposes on such a circle would probably have a width equal to quite 10 seconds of arc; and it follows that the minute V-shaped cut forming this line must be so absolutely symmetrical with its center line throughout its length, that the position of this center may be determined within the limit of error just stated by observations of the edges of the line, made by the aid of the reading micrometer and microscope. I may say that after the machine just mentioned had been made, it took over a year's hard work to reduce the maximum error in its gradutions from 1½ to 1 second of arc.

But astronomers also call upon mechanical engineers for work of a much heavier class, and work which involves the surmounting of quite special difficulties. For instance, the mounting of such a giant telescope as that at the Lick Observatory, at Mount Hamilton, or that at the Yerkes Observatory, at Williams Bay, Wisconsin, is a task far beyond the powers of any ordinary instrument maker, and is really a piece of engineering work requiring not only the highest mechanical skill in its design, but the command of exceptional workshop appliances for its execution. Thus, in the case of the Yerkes telescope, which has an aperture of 40 inches, the weight of the whole instrument is no less than 70 tons, while the parts which have to be put in motion to set the telescope on a star weigh 22 tons; and this weight must

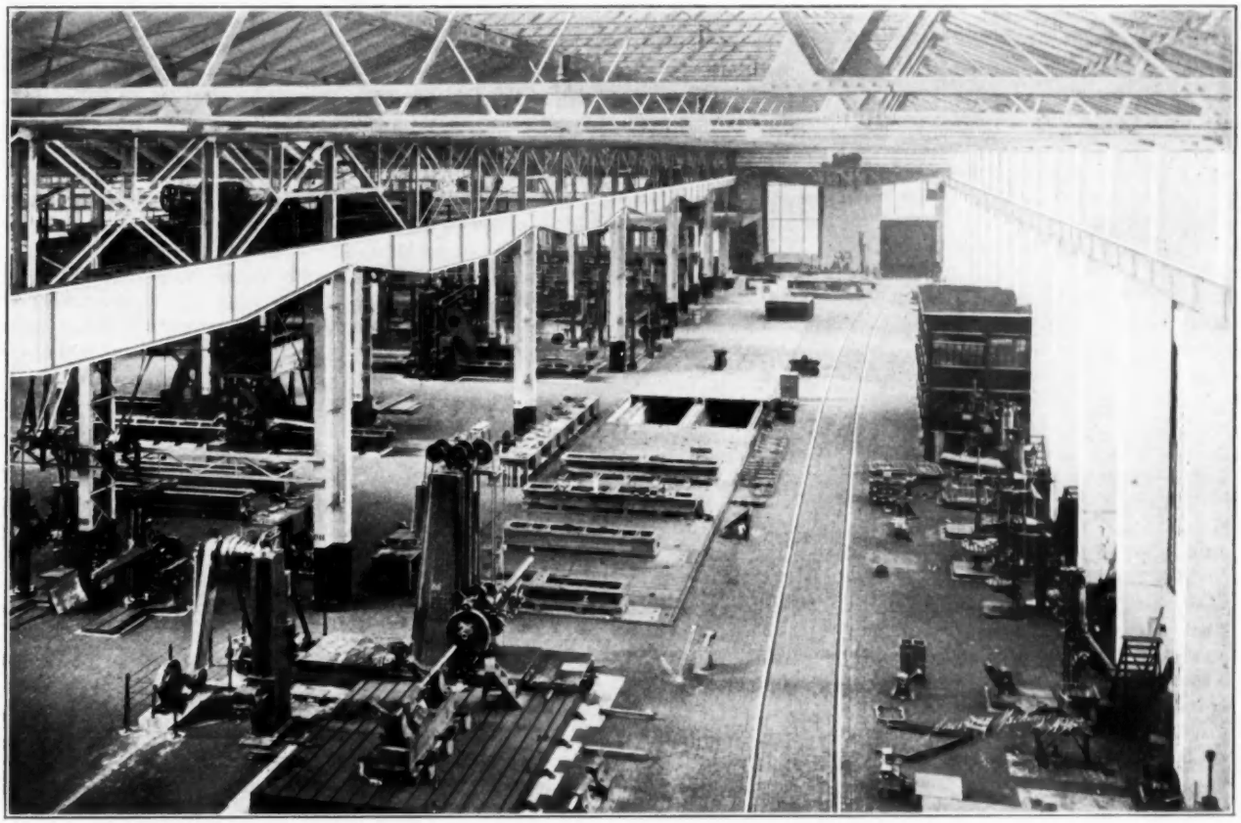


FIG. 35. VIEW OF ERECTING AISLE AS SEEN FROM ONE OF THE CRANES WHEN AT ONE END OF THE AISLE.

be capable not only of being readily moved by the observer, but of being kept moving steadily at the rate necessary to counteract the rotation of the earth, and thus maintain the object under observation in a constant position in the field of view. As the conditions to be satisfied in this case constitute a problem which does not often come before mechanical engineers, I may perhaps be allowed to give a few facts which will serve to indicate the difficulties to be overcome. The popular idea of these large telescopes is that they afford enormously magnified images of celestial objects; and there is, so far, a foundation for this belief in the fact that with a large telescope a greater magnifying power can be employed than on a small one; and so, in the case of such objects as the moon, planets, nebulæ, or comets, exhibiting definite areas, the images may be larger than they could be in smaller instruments. But one of the chief advantages of these large telescopes is not the greater size of images which they are able to give, but their greater resolving power, or their power of showing details which in a small telescope would be entirely lost. This power is illustrated, for instance, by the effect when observing the fixed stars. These bodies are at such enormous distances from us that even in the most powerful telescopes they behave as simple points of light and present no area which can be increased by magnification. It is quite true that when a star is observed in a good telescope a defined disk is seen; but this—the spurious disk, as it is called by astronomers—is a diffraction effect; and it follows from the wave theory of light that the dimensions of this disk, expressed in angular measures, will *decrease* in direct proportion to the increase in the diameter of the object-glass of the telescope used. In a good 5-inch telescope the spurious disk shown by a star of about the seventh magnitude—or a star having a brightness a little less than half that of the faintest star which can be seen with the naked eye—will have a diameter of rather less than I second of arc; and it thus follows that to be seen as independent objects in such a telescope, two stars must be not less than about 1 second of arc apart from center to center. But in the Yerkes telescope of 40 inches diameter, the diameter of such star disks would be under one-eighth of a second of arc; and thus two such stars, which are but one-eighth of a second of arc apart from center to center, can be seen as clearly separate objects, and their relative positions measured.

It has been necessary to mention these facts to explain the problem to be satisfied in the case of the mounting of the Yerkes telescope. In that telescope the star images of which I have just spoken as having an angular measure of rather less than one-eighth of a second of arc, will have a linear measure at the focal plane of about 1-2500 inch diameter. Now, this focal plane is situated at a distance of about 32 feet from the polar axis on which the telescope rotates; while the spider webs—or so-called "wires"—of the micrometer used for star measurements will have a diameter of about 1-5000 inch to 1-7000 inch, or, say, a mean of about 1-6000 inch. The problem thus is to move this 22-ton mass with such steadiness in opposition to the motion of the earth that a star disk 1-250 inch diameter can be kept threaded, as it were, upon a spider web 1-6000 inch diameter, carried at a radius of 32 feet from the center of motion. I think that you will agree that this is a problem in mechanical engineering demanding no slight skill to solve; but it has been solved, and with the most satisfactory results. The motions are controlled electrically; and respecting them, Professor Barnard, one of the chief observers with this telescope, some time ago wrote as follows: "It is astonishing to see with what perfect instantaneousness the clock takes up the tube upon the application of the electric clamp in right ascension. The electric slow motions are controlled from the eye-end. They move the telescope slowly in right ascension and declination. Their motion is beautifully steady. So exact are they that a star can be brought from the edge of a field and stopped instantaneously behind the micrometer wire." It is satisfactory to know that the engineer chiefly responsible for the design and construction of this mounting is one of our own members, Mr. Ambrose Swasey.

Twist Drill Tests.

BY EUGENE C. PECK.

There is probably no other tool that is so misused, or that is required to perform as heavy duty with as little care as the common twist drill. The ordinary commercial article is expected to drill any metal at almost any speed or feed, and it is quite common now to see drills doing work under such severe conditions that, if it were not for the name of the machine the tool is used in, one would be in some doubt as to whether the work was being punched or drilled.

As an instance of this, in several places 15-16 inch drills are expected to drill the bolt holes in steel rails (60 point carbon) at a speed of 150 revolutions per minute with a feed of .020 inch per revolution, and special temper for this work is precluded by the fact that the users expect to purchase of any dealer carrying a stock of drills.

In order to get the best possible results from twist drills, the most efficient form of cutting edge combined with a good temper is of course essential, and next to this,

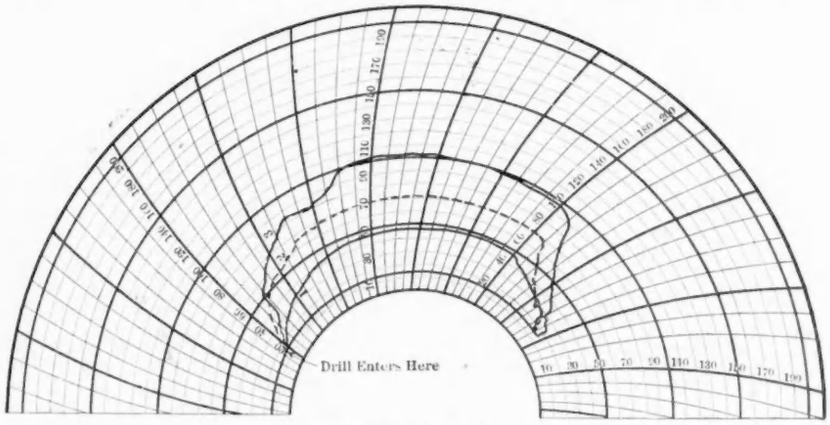


Fig. 1 Feed Pressure Chart

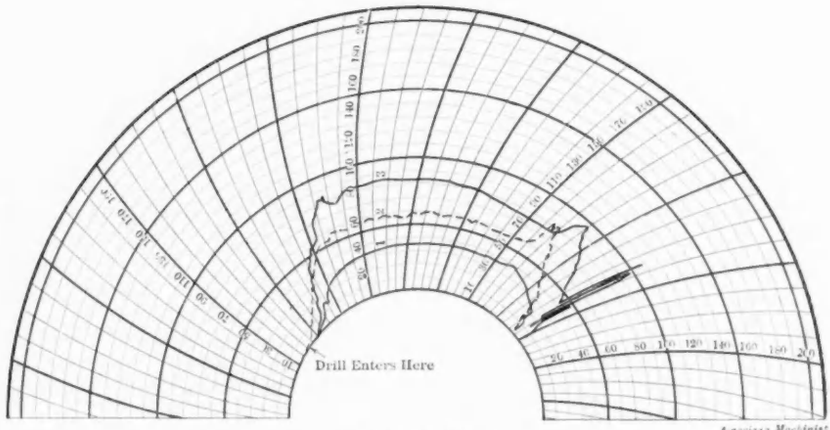


Fig. 2 Torsion Chart

AUTOGRAPHIC RECORDS OF PRESSURE AND TORSION ON TWIST DRILLS IN ACTION.

probably, is the proper grinding or backing off of the lips, and few operations on tools are more disappointing or so little understood even among good mechanics. Evidence of this is frequently forthcoming in the return of drills ground on some of the machine "point grinders." There is quite a variation in the efficiency of some of the "drill point grinders," and I hope in a future article to give some data concerning experiments made with drills ground on some of these machines.

Realizing that the twist drill of the future must be a more efficient tool than ever before, as regards the amount of stock removed in a given time and the power consumed in removing it, the Cleveland Twist Drill Company has built a testing apparatus to automatically record the feed pressure and the torsional stress on a drill in operation, and hope with its aid to produce a drill very much superior to anything made up to this time. The apparatus is very similar to that of Prof. Breckenridge's, described in the "American Machinist" a few years ago.

The swinging table is fitted with a piston connected by a "wabble joint" to the journal on under side of table, both piston and journal being a good fit inside a larger piston, with provision to clamp either piston separately or together. For drills over ¾ inch both pistons are clamped together, giving the area of larger piston plus area of smaller one to resist the feed pressure of drill, and for smaller drills the large piston is clamped to cylinder, allowing only smaller one to resist feed pressure.

The resistance of the table to turning, plus the friction, is equal to the torsional stress on the drill, and an angle-edged piece is bolted 10 inches from center of table and engages the end of a piston 1 inch in area, the cylinder of which is bolted to the column of the drill press; which gives a ready means of measuring the twisting strain.

These cylinders are each connected to a Bristol recording pressure gage, the clock mechanism of which is replaced with a spring drum, around which a cord is passed to the spindle of drill press, to revolve the chart holder as the drill is fed into the work. When completed, the table was weighted carefully up to the highest range intended to be used, and at different steps lines were drawn upon the charts representing the pressure produced by the different weights and the gage was corrected to match the printed charts. By attaching weights to the periphery of the table the same tests were gone through to correct the torsion gage, and it is remarkable what a small difference there was in the friction of the ball bearing under the table with and without a load.

While the apparatus may be open to some criticism from a scientific standpoint, practically it answers the purpose for which it was designed, very nicely, and an ordinary workman can handle it with little attention. There are no leaky joints, and up to the present time nothing has developed to indicate but that the records are fairly accurate.

The accompanying charts are from a 1¼-inch drill, running 66 revolutions per minute with a feed of .0075 in cast iron, machinery steel and annealed tool steel. The concentric circle on feed pressure chart between lines reading 10 and 20 represents the weight of table and "billet" drilled into. The lines marked 1 are cast iron and show quite a uniform curve, while the lines marked 2 and 3 are respectively machinery steel and tool steel, and show more irregularity in the curves. The general contours of the feed pressure curves for tool steel are very much alike, showing a steady rise until the lips are cutting nearly full size, then dropping slightly, due to the spiral helping to pull the drill in; then rising again steadily to a point about a third through the billet, due no doubt to the billet not being annealed uniformly clear through.

The feed pressure diagrams fall off very rapidly as the point begins to come through, while the torsion diagrams for steel rise very abruptly; and in the tool-steel one, the piece not being clamped down, it shows plainly where the lips caught and raised the piece, giving several very quick jerks, similar to what is experienced very often in holding a piece by hand to drill it.

These points indicate where the outer part of the lips are generally broken, especially where lever feeds are used, or the spring between the parts taking thrust is considerable. This feature is very common in the drilling of the rivet holes in cylindrical shells where the inside curvature greatly augments the tendency of the drill to "hog in."

The feed in this test was purposely kept down to what may be termed fair practice in order to have the same grinding answer for all three holes, and the drill was in perfect condition at the completion of the test.

The difference between the curved lines pointing toward the center represents a distance of .05 inch in the depth drilled on both charts. For the actual number of pounds on feed pressure chart, multiply by 20, and on torsion chart multiply by

$$\frac{20}{\text{diameter of drill}}$$

or 16 in this case.

Bending Dies.

BY JOS. V. WOODWORTH.

In Fig. 1 is shown a blank which, after being bent and formed as in Fig. 2, acted as the movable top of Fig. 5, the blank, Fig. 3, formed as in Fig. 4, being the bottom. The dies here shown were the simplest and most practical that could be devised under the conditions, as cheapness was essential; at the same time they were made to wear well and to turn out reliable work. To form the blank, Fig. 1, to the shape shown in Fig. 2 only one operation was necessary. The punch and die for this are shown in Fig. 6. The punch, a forging of tool steel, was made first. After the stem had been turned and the shoulder faced, it was milled to the length as shown and in width a good fit between the two wings of the piece when bent over; the shape shown was also worked out on the face of the punch. It was then hardened and drawn from the back, leaving the back a dark blue and the face a very light straw color.

For the die a bolster of cast iron was first got out and a slot planed through the top lengthways to the depth shown and wide enough to admit the tool-steel die *H*, which was milled out to the depth, width and length shown, leaving stiff sides, as shown at *C*, and the ends *E* and *H*; that

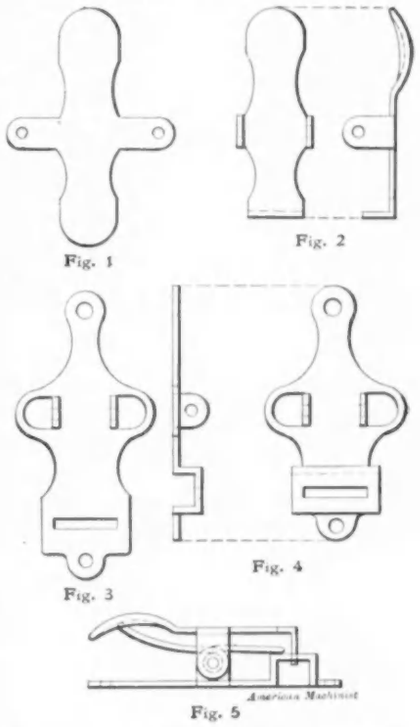


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

THE BLANKS AND WHAT THEY FORMED.

is, two thicknesses of metal wider than the width of the punch and one thickness of metal longer. The shape shown at *F* was also worked out to form the thumb rest. The die was then hardened and drawn to a very dark blue, drawing the sides almost soft. It was then fastened in the bolster *C* from the bottom by means of the two flat-head screws. A gage plate *G*, for the blank to center in, was fastened to the top of the bolster by the four screws *L* and eased up so that the blank would rest within it nicely. The punch and die were then set up in the press, and, the punch descending, the blank was bent and forced into the die, striking the bottom of the die solidly and leaving a good finish on the work; the piece was then complete.

The punch and die for bending and finishing the base or lower part of Fig. 5 were then made, the punch first. The cast-iron holder *Q*, Fig. 7, was turned and a

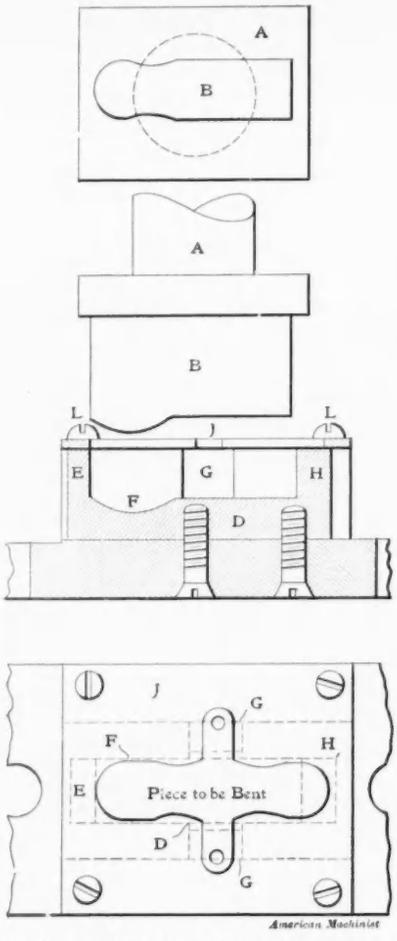


FIG. 6. PUNCH AND DIE FOR BENDING FIRST PIECE.

slot, 3-16 inch deep, was milled lengthwise through the face at *R* to admit the tool-steel blank for the punch *M*, which was made to the shape shown, with the former at *N* and the locating point *O*, it also being cut away at *P P*, the locating tip *O* fitting the slot in the end of the blank. Two holes were drilled through the back of the holder for the two screws *S S* and transferred to the punch. After these were tapped the punch was hardened and drawn to a light straw color and fastened in the holder Q by the two screws mentioned, and it was then complete.

The die was very simple, consisting of the cast-iron bolster *V*, in which a slot was milled sideways on the top to admit the tool-steel die *T*, which was a square piece of tool steel, in hight sufficient to be even with the face of the bolster, with a slot *U* milled through it, two thicknesses of metal wider than the punch and in depth the same as N. The edge of it was left square and rather sharp, so as to leave a square corner in the finished work. Two holes were drilled through the bottom of the bolster for the two screws *X X* and tapped into the die, which was then hardened and slightly heated, leaving it as hard as possible. Two oblong slots *W* were let into the face of the bolster and deep enough to allow clearance all around for the two wings of the work. A gage plate *Y*, of ⅛-inch cold-rolled machine steel, was worked out to accommodate the blank. It was then located and fastened in the proper position on the face of the bolster by the four screws *Z*. The punch and die were then set up, the blank Fig. 3 being placed within the gage plate *Y* and the punch descending, the tip *O* entering the slot in the blank and holding it central while it was being bent.

A Multiplying Index for the Slide Rule.

The accompanying illustrations show a device applied to a common slide rule for increasing the accuracy of the readings. By it the last figure, which is ordinarily estimated, is read positively, and an additional figure, which ordinarily must be ignored, may in most positions on the scale, be estimated.

The usual index bars of the runner are here connected to the radial arm in such manner that swinging the arm causes the bars to slide in their frame lengthwise of the rule. The radial arm carries a sliding pointer which reads the radial scale on the celluloid plate over which the arm turns.

As shown in the illustration, it is desired to read on the A scale the position of the middle 1 of the B scale. To do this, the radial arm is swung to the left-hand limit of its movement, and the index as a whole is adjusted until the mark on the index bar registers with 21 of the A scale, as in Fig. 1. The radial arm is then swung to the right, without disturbing the index as a whole, until this same mark registers with 22 of the A scale, when the sliding pointer is adjusted lengthwise of the swinging arm until its index point rests on the 10 line of the fan-shaped scale, as shown in Fig. 2. As now adjusted, the movement of the arm index from 1 to 10 corresponds with a movement of the bar index from 21 to 22, and by this adjustment the arm index may be properly set for any length of division on the A scale. In other words, whatever the length of a division on the A scale, the arm index may be so set as to make the readings on the enlarged fan-shaped scale. This adjustment made, the arm is now moved again to the left until the mark on the lower side of the index bar registers with 1 of the B scale, the position of which it is desired to read, as in Fig. 3, when the point of the arm index gives the reading as 86, the 8 being read positively and the 6 being estimated. The complete reading is thus 2186. Without this index the most exact reading possible would have been 218, of which the last figure is estimated.

It will be clear from the engravings that the instrument may be used equally well on the lower scales of the rule.

The instrument is known as the Golding cursor, and is made by John Davis & Son, of Derby, England, who have a branch house at 140 West Fayette street, Baltimore, Md.

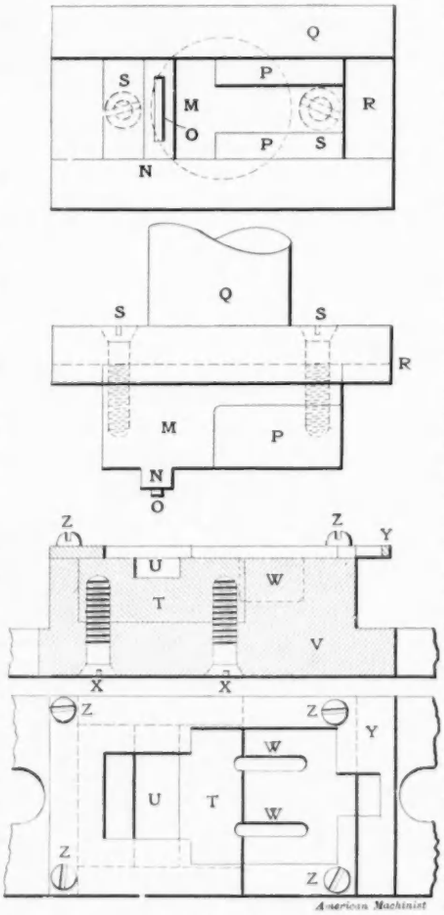


FIG. 7. PUNCH AND DIE FOR BENDING SECOND PIECE.

An Improved Automatic Rack Cutting Machine.

The half-tones give us two views of a new automatic rack cutting machine. It is a modication, in a sense, of the well-known Hendey pillar shaper. The column is the same as is used for the 28-inch shaper; the ram, or cutter bar, also maintains the similarity, with the exception of the head, which, for the rack cutter, is suitably arranged to carry the cutter and its necessary driving mechanism. The cutter is centrally located, carried on an arbor suspended in substantial bearings at either end, giving greatest rigidity. It is driven through a train of gears back-geared from the driving pulley. On the end of the intermediate gear shaft is a five-step feed pulley, belted to a corresponding pulley bracketed directly to the ram. This pulley, through sun and planet gearing and clutches on the shaft, affords suitable feeding speeds, with a quick return of the ram. The ram is fed forward and backward by means of a worm-thread screw, running in a large nut, the end of the screw being carried to the rear of the ram, where means are provided for taking up all lost motion. The trip for the feed is provided with a locking spring and

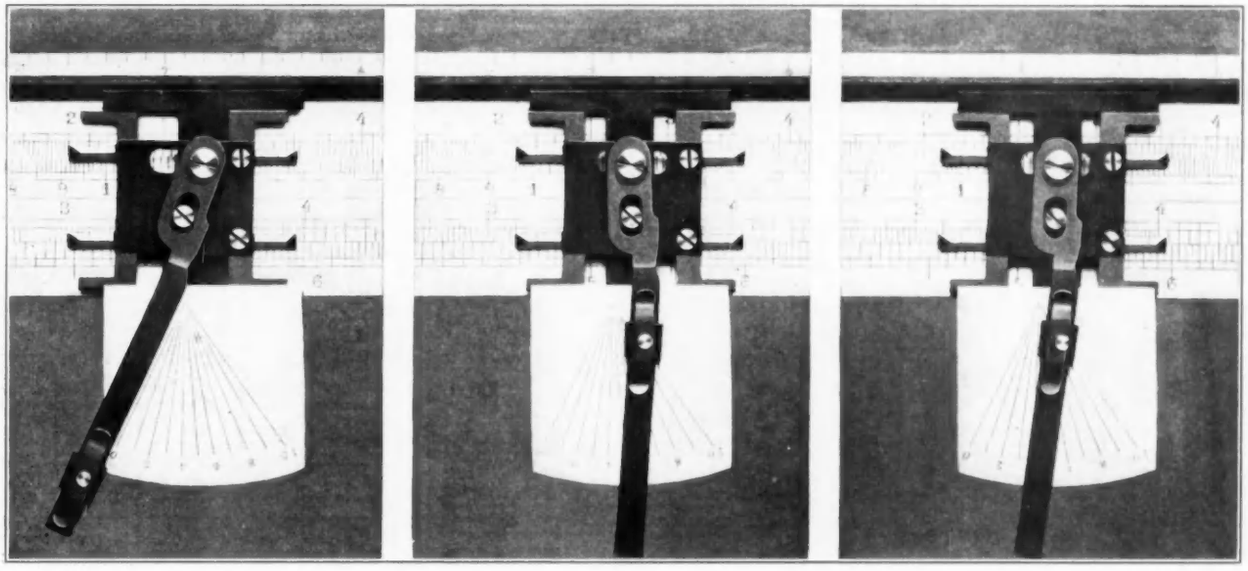
point, to hold the feed shaft clutch firmly in position, this mechanism being the same as is used on the shaper for reinforcing the friction clutch when driven at very slow speeds.

The knee carrying the work table is solidly bolted to the column in permanent position, all vertical adjustment for the cutter being obtained in the head. The down feed is provided with a large dial, suitably graduated, and an index pointer reading to thousandths. The countershaft bearings are carried on elevating screws, connected through cross rod and bevel gearing, operated by suspended handle within easy reach, so fitted as to afford a means of maintaining the same relative distance between pulleys for belt tension, and also for tightening the belt if occasion requires.

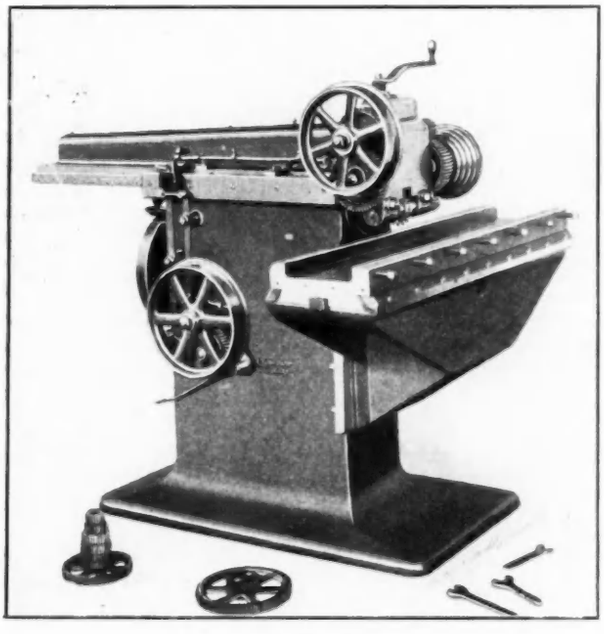
The indexing of the work table is accomplished in the ordinary manner, with a large dividing wheel and worm, driven by change gears, connected with a driving shaft running at right angles through the base, terminating in a cam head. This cam is driven by a pulley belted to a separate countershaft, which is started and stopped automatically at the end of the return stroke of the ram, starting being accomplished by levers actuated by a dog on the ram.

The cam and shaft make but one revolution, all pitch changes being accomplished by the necessary change gears which go with the machine. Upon coming to rest, the cam is securely locked by plungers. The worm is carried on a sliding bracket, which admits of its being adjusted into the worm-wheel for taking up wear. Keyed to the opposite end of the worm-wheel shaft are two accurately cut gears, meshing into a double rack fastened directly to the work table. The gears, and consequently the racks, are so placed as to bring the teeth of one opposite the spaces of its neighbor, for the purpose of obtaining a more uniform travel of the table than could be had with a single gear and rack.

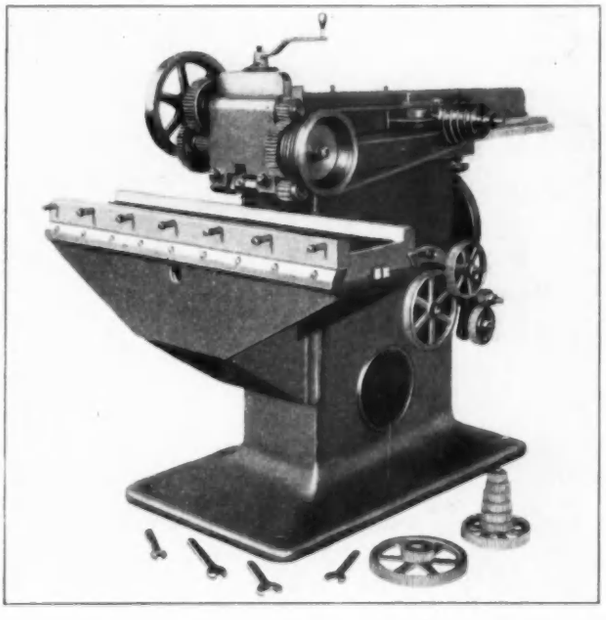
The table holds the rack blanks after the manner of an ordinary vise, and upon reaching the finishing end of the cut, the work can be quickly taken out and a



GOLDING'S MULTIPLYING INDEX FOR THE SLIDE RULE.



AUTOMATIC RACK CUTTER.



AUTOMATIC RACK CUTTER.

WIDTH OF PLATE IN INCHES	DEPTH OF BEAM	WEIGHT OF BEAM	SECTION FACTORS (LIGHT FIGURES FOR TENSION MEMBERS. HEAVY " " COMPRESSION ") THICKNESS OF PLATE 3/8"	1/2"	5/8"	3/4"
4 5/8	10	25 - 30	**8.67**	**11.64**	**14.54**	
			5.64	7.53	9.41	
5	10	35 - 40	**9.42**	**12.55**	**15.72**	
			6.32	8.43	10.57	
5	12	31 1/2 - 35	**11.32**	**15.05**	**18.20**	
			7.57	10.58	12.12	
5 1/4	12	40	**11.82**	**15.85**	**18.30**	
			8.17	10.89	14.02	
5 3/8	12	45	**12.14**	**16.15**	**20.35**	
			8.72	11.29	14.08	
5 1/2	12	50	**12.37**	**16.55**	**20.71**	
			8.80	11.76	14.52	
5 5/8	12	55	**12.68**	**16.85**	**21.35**	
			9.02	12.04	15.08	
5 1/2	15	42 - 45	**15.03**	**20.65**	**25.91**	
			10.91	14.59	18.58	
5 5/8	15	50	**15.12**	**21.25**	**26.60**	
			11.27	15.04	18.83	
5 3/4	15	55 - 60	**15.22**	**21.45**	**27.11**	
			11.57	15.49	19.73	
6	15	65 - 70	**16.92**	**22.56**	**28.37**	
			12.32	16.44	20.59	
6 1/4	15	75	**17.60**	**23.71**	**29.32**	**35.38**
			13.17	17.65	22.09	26.51
6 1/2	15	80 - 85	**18.33**	**24.47**	**30.63**	**36.82**
			13.72	18.35	23.00	27.57
6 5/8	15	90 - 95	**18.63**	**24.87**	**31.23**	**37.48**
			14.52	18.80	23.80	28.48
6 3/4	15	100	**20.28**	**25.32**	**31.74**	**37.74**
			14.57	19.25	24.10	29.08
6	18	55 - 65		**27.06**	**33.87**	**40.07**
				19.74	24.59	29.65
6 1/4	18	70		**28.46**	**35.23**	**42.44**
				20.85	26.09	31.36
6 1/4	20	65 - 70			**39.13**	**47.09**
					29.00	34.86
6 1/2	20	75 - 80			**40.83**	**48.92**
					30.59	36.77
7	20	85 - 90			**43.90**	**52.75**
					33.76	40.44
7 1/4	20	95 - 100			**45.40**	**54.76**
					35.61	42.80
7	24	80 - 85				**63.25**
						48.44
7 1/8	24	90 - 95				**64.45**
						49.70
7 1/4	24	100				**65.56**
						51.38

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TABLE 1. SECTION FACTORS OF FLANGE COVER PLATES.

new lot of blanks inserted and the travel of the table reversed, thus doing away with the necessity of bringing the table back to one starting point. The machine has a capacity of 4 feet in length at one setting, 8 inches in width, and the regular gearing provides for from 2 to 20 diametral pitch. It is built by the Hendey Machine Company, Torrington, Conn.

I-Beam Girders With Re-enforcing Plates.

BY C. F. BLAKE.

In the "American Machinist" No. 40, of last year, I gave some formulas for the calculation of the strength of I-beams re-enforced with cover plates upon the flanges. The accompanying chart and tables will be found convenient in such problems. In the first table are tabulated the section factors of various thicknesses of cover plates when applied to different sizes of beams. The heavy figures are for plates on the compression flanges, and the light figures for plates on the tension flanges, the area of two 13-16 inch rivet holes having been deducted from the area of the latter plate. The section factors from the table are to be added to the section factor of the beam, and the sum to be multiplied by the allowable fiber strain to obtain the safe bending moment in inch-pounds for the girder.

Example: A 15-inch 42-pound I-beam is to be re-enforced with a 5/8-inch plate on each flange. What will be the safe bending moment in inch-pounds to allow upon the grinder, the fiber strain to be 12,500 pounds per square inch? From the handbook of one of the steel companies we find the section factor of a 15-inch 42-pound beam is..... 58.9

From the table the section factor of the 5/8-inch compression plate for a 15-inch, 42-pound beam is..... 25.91

and for the tension flange..... 18.58

Total section factor for girder. 103.39

Then 103.39 × 12,500 = 1,292,375 inch-pounds for the allowable bending moment upon the girder.

DEPTH OF BEAM	SECTION FACTORS FOR TWO SPLICE PLATES 3/8"	1/2"	5/8"	3/4"
24"	55.7	74.0	93.0	111.5
20"	37.6	50.3	62.5	75.5
18"	30.5	40.5	51.0	61.0
15"	20.5	27.5	34.3	
12"	12.6	16.8	21.0	
10"	8.5	11.4	14.2	
9"	6.5	9.0		
8"	5.3	7.0		
7"	3.9	5.2		

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TABLE 2. SECTION FACTORS FOR WEB SPLICE PLATES.

The second table is intended to simplify the calculations for splice plates on the web for use where the beam is too short for the span. The table assumes that the plates are an accurate fit between the

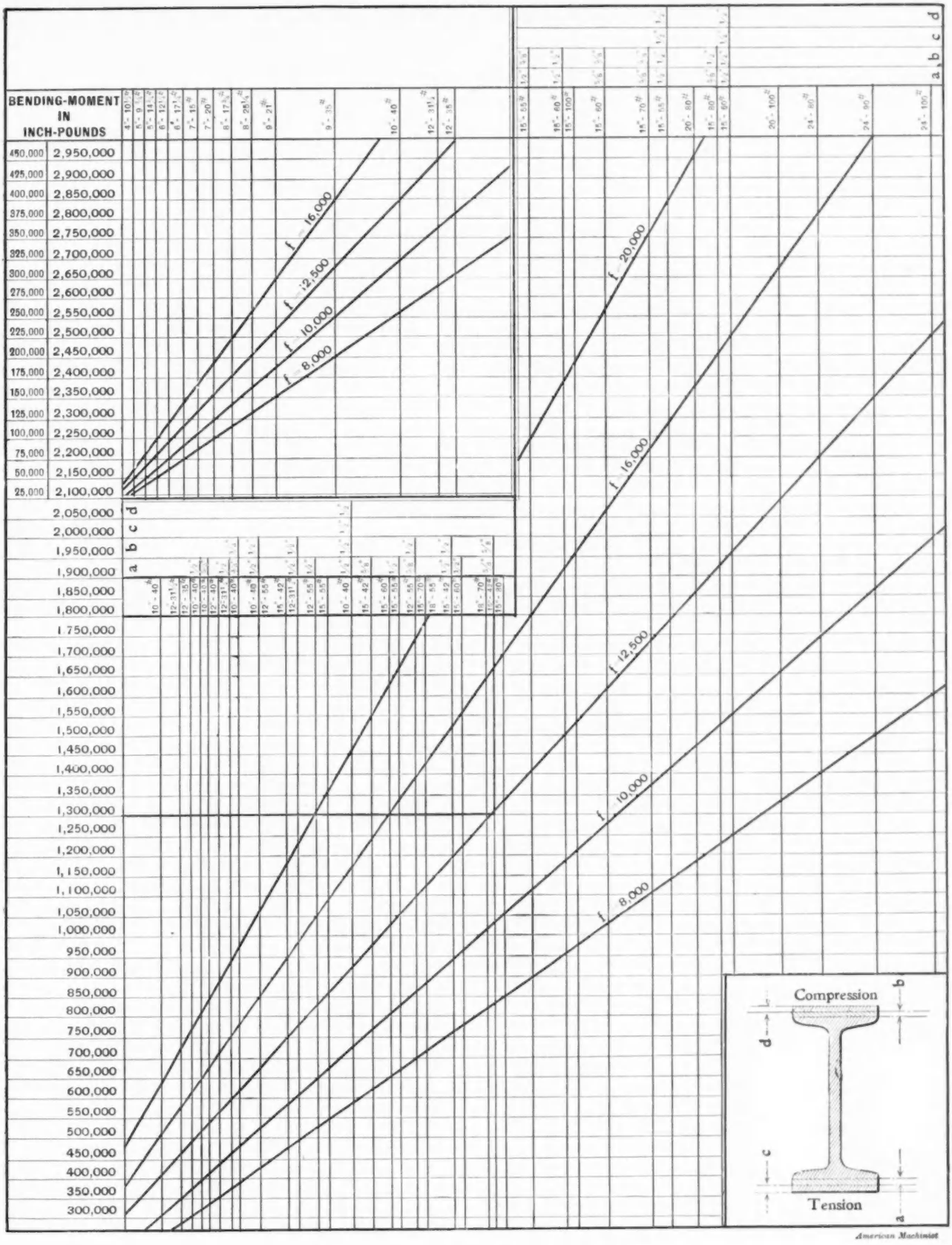


CHART FOR FINDING THE STRENGTH OF I-BEAMS.

flanges. If plates are wanted on the flanges as well as on the web plates, the section factors from the first table are to be added to the section factor from the second table.

Example: It is desired to splice the beam in the above example, retaining in the splice the entire strength of the beam.

From Table 2 for web splice plates, the section factor of two ½-inch plates for a 15-inch beam is..... 27.5

From Table 1 for flange plates the section factors for ½-inch plates for 15-inch, 42-pound beams are:

Tension plate..... 14.59
Compression plate..... 20.65

Total section factor of splice..... 62.74

Section factor of beam is 58.9. Thus the splice possesses greater strength than the beam.

The chart enables one to pick out a beam or a beam with cover plates for any bending moment and fiber strain. The small chart in the upper corner is to be used with the short row of bending moments at the left. The letters *a*, *b*, *c* and *d* denote the position of the plates, whether on the tension or compression flange, according to the figure in the lower corner.

Bolt Diam.	Length	D Round	E Square
⅝"	24"	1⅛"	9"
⅞"	30"	1⅛"	9"
1"	30"	2"	9"
1⅛"	36"	2"	9"
1¼"	36"	2"	9"
1⅜"	42"	2"	9"
1½"	42"	2½"	9"

Example: A bending moment of 1,292,375 inch-pounds is to be taken by a beam at a fiber strain of 12,500 pounds per square inch, required the size of beam and cover plates. The nearest bending moment on the chart is 1,300,000. Follow the line from this to the diagonal line for 12,500, thence up, and read the size of beam and plates as 15-inch, 42-pound beam with two ⅝-inch cover plates.

An oak of good size is said to lift 123 tons of water during the months it is in leaf. This is, say, 250,000 pounds, and if the water is lifted to an average hight of 30 feet this makes 7,500,000 foot-pounds, which equals a horse-power for 227 minutes, or nearly four hours. This is small, however, compared with lifting the same water eventually to the clouds, say 1,000 feet.

Letters from Practical Men

Some Points in Drawing-Room Practice.

Editor American Machinist:

In this article I would present to your readers my recent experience in arriving at a very much improved method of making foundation plan drawings.

By many it is thought sufficient to give only a few lines to show the general appearance of the machine, and there are many such plans in use which but poorly serve their purpose.

Being interested, as an amateur, in photography, I was led to experiment on reducing our large drawings, 26x38, to a size convenient for mailing purposes, having in view the advantage of the foundation plan accompanying the letter in the first-class mail; thus avoiding the risk of loss and the extra expense of the "under separate cover," second-class mail, and the comparative cost of a 26x38-inch and a 10x12-inch blueprint—about 8 to 1.

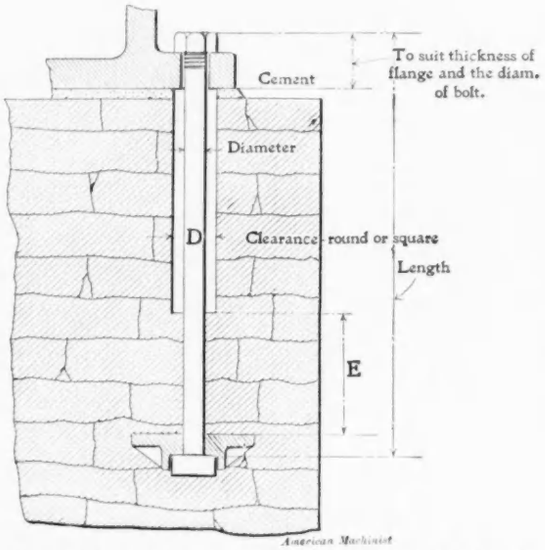


FIG. 1. SUGGESTED METHOD OF SETTING FOUNDATION BOLTS, ALLOWING SLIGHT ADJUSTMENT TO SUIT HOLES IN MACHINE BED OR SIDE PLATE.

I first tried 8x10, but found 10x12-inch plates the better size, and have now in use about one hundred of these plates, which are being continually added to. Only one negative has been accidentally broken, and this, considering the large number of prints that have been made by the boys in the blueprint room, dismisses the question of losses on that account. Some of the disadvantages of the old way would be shown when a foundation plan was called for, to send out an inquiry regarding space the machine will occupy, or when an order was received, etc. The drawings, from being many times handled, had gathered a lot of dirt, and only poor prints were then obtained, it being necessary to retrace them. Being large prints, they were made only to order, and required time, considerable time in bad weather, thus causing delay; and they were, as previously stated, mailed under the separate-cover system, with its defects and added expense.

Compared to the foregoing, we now have prints which are almost perfect, and all who see them are greatly interested. In appearance they equal an original drawing in combination with a photograph of the machine, the photograph being used for the convenience of those who more readily understand the machine photograph than the drawing. They are like an original drawing, because by using black printing paper (though blue lines look very well), the photograph plate being the negative, black lines and lettering and a picture of the machine can be produced on a white ground. The 10x12 prints are of such a convenient size that a number of each are always in stock, requiring but small filing drawer space. From this stock call orders are given prompt attention, and the print can always accompany the correspondence, a convenience to the inquirer or the customer.

As to the cost of the plan: The plates are made by a local photographer at $1 each. The drawing or tracing is then put away, and should changes occur on the machine, these can be corrected and another plate be made from it. Had the tracing, by the old plan, been much used and soiled, it would have been found necessary, as the best plan, to make a new tracing, requiring, most likely, much more than a dollar's worth of time in the drawing office. The prints from the plates are as one-half cent per plate print to six cents per large tracing print, in addition to the mailing expense. Using black printing paper, the cost per print is one cent.

When making these drawings for photographing, the lines, lettering and dimensions must be larger and heavier on account of the reduction to one-eighth size. Letter-head copy of the firm's name and a photograph of the machine can be lightly

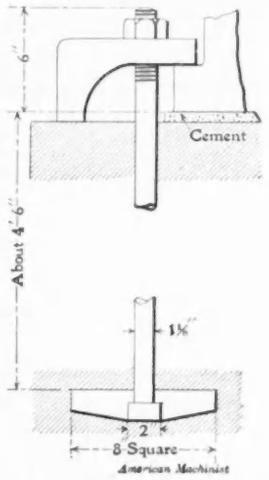


FIG. 2. GOOSE-NECK CLAMP FOR FOUNDATION BOLTS.

attached to the drawing wherever desired, giving quite a marked effect. In place of the usual note regarding the scale of the drawing, a length of such scale is drawn in, and, being reduced with the drawing, it still remains the scale of the drawing. Though we cannot say 1½, etc., equals 12 inches, yet we are enabled by it to take off any measurements by means of a compass, or even a lead pencil. In other respects the drawings are made, not as used, but are drawn to give the desired information for correctly locating where it may be possible to put the machine in the customer's work.*

Gordon Company's works. The method allows of slight adjustment to suit holes drilled in the frame, though this adjustment is not necessary when goose-neck clamps and lugs are used as shown in Fig. 2. Countershaft information must give speed, width of belts, the centers between hangers, the drop, and the size of the driving pulleys, the latter to enable the diameter of the line shaft pulley being worked out.

All bolt centers and foundation dimensions are given, avoiding the use of fractions of an inch, which is possible, except in a few instances of bolt centers where

The shellac can also be used for blocking out when necessary, even in making certain changes on the plate.

Fig. 3 reproduces some photographs of our electric light blue-printing machine, one picture having been taken while in operation. This photograph was made late in the afternoon of a dull day. Your readers will recognize this as the machine you described in issue No. 51 of last year, where it first interested me, and the Niles Tool Works Company quickly had one installed. Of it I would say that it surpasses all expectations, making beautiful even-colored blueprints every three min-

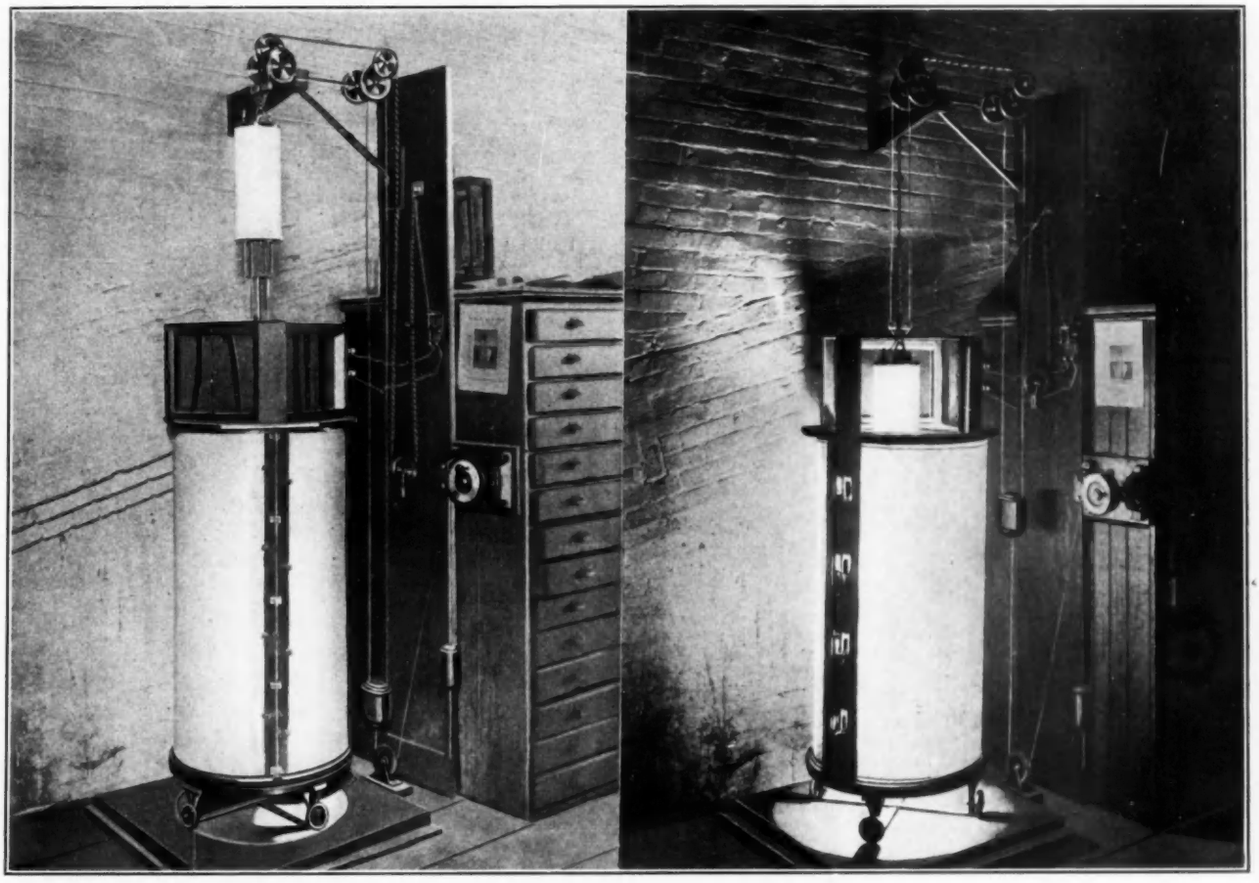


FIG. 3. ELECTRIC-LIGHT BLUEPRINT MACHINE WITH FRAME FOR HOLDING NEGATIVES.

Regarding such drawings, I would say that they must contain front and end views showing space occupied and a plan view clearly giving the necessary instruction to the stone-mason. While foundation bolts may not be furnished with the machine, yet it is well to suggest a method of placing such bolts with lengths, etc.. Such a method, with table of necessary bolt lengths, etc., is shown in Fig. 1.† This was suggested to me by a draftsman who had seen it in use at the Laidlaw-Dunn-

½ or ¼ inch might be allowed, but not for masonry work.

To any of your readers who may wish to introduce this practice, I would say that it was after much experimenting on the part of the photographer with various plates that he arrived at the perfection which is now attained. A slow process plate carefully developed so as to produce a very sharp contrast with lines clear cut and density in the plate is needed. Such a plate will print about as quickly as tracing linen, giving sharp lines and a good white ground. In photographing it is impossible to get an equal margin line, but, by using the common black shellac from the pattern shop, the irregular border lines can be shellacked over. When dry, a new ½-inch border line can be cut in the plate.

utes. Its holding capacity equals two of our large frames, and in cloudy weather it is taking the place of nine such frames. It is actually quicker than sunlight and so easy in operation that the blueprint boys are in love with it. A grand invention filling a long-felt want.

To enable it to print from photograph plates, I have devised the removable frame attachment seen on the top of the cylinder, leaving four openings into which the printing frames are placed. The light passing through acts on the plates without at all interfering with the work of printing below it. Though the plates present four flat surfaces eight inches from the light, the results obtained are perfect and certainly cannot be improved by the sunlight.

Hamilton, Ohio. WM. PILTON.

*As these plans are photographic prints, we cannot well reproduce their characteristics. They are admirable in every respect, and the inclusion of a photographic view adds much to the effect. In size and convenience of mailing they are much to be preferred to the usual style.—ED.

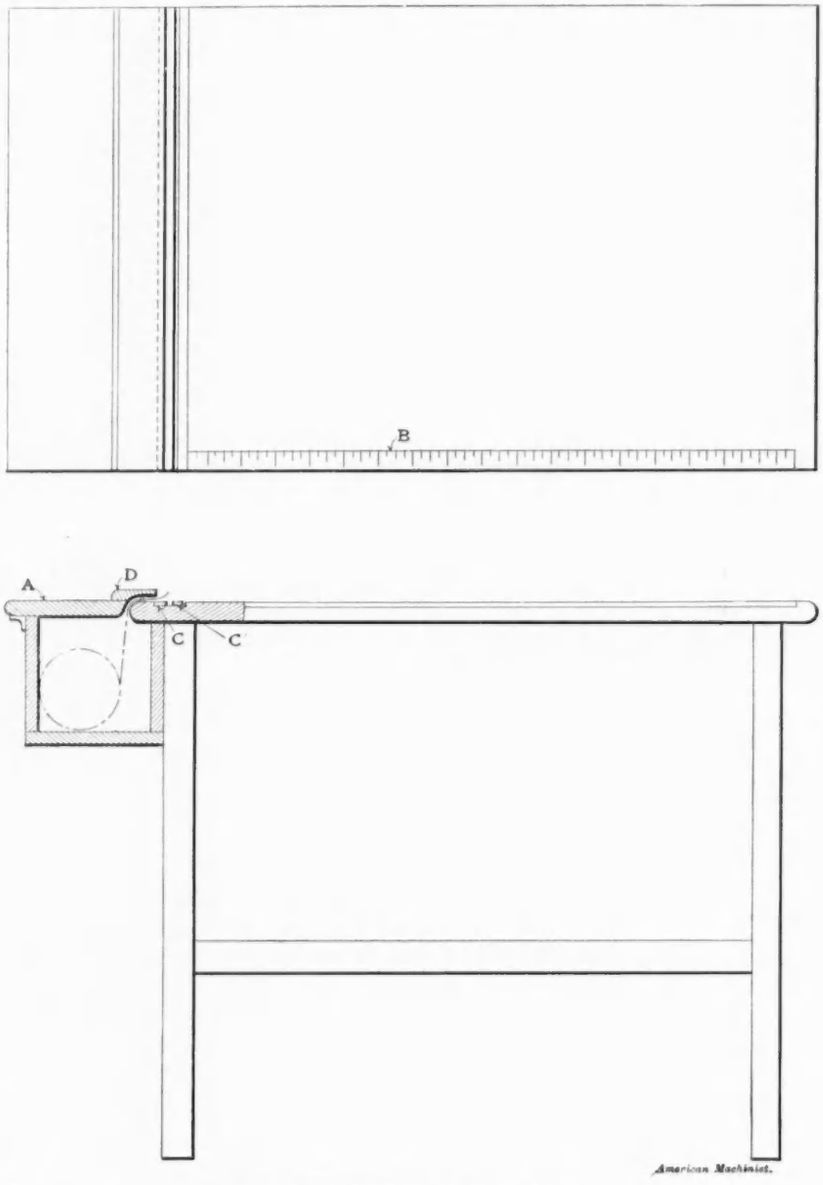
†This is a common practice among engine builders. There is no need of having the bolt fill the hole, though if the customer imagines there is, he may pour in thin cement after the bolts are in place.—ED.

Scheme for Cutting Drawing Paper.

Editor American Machinist:

All drawing rooms should be provided with some device by which the drawing paper may be cut to standard sizes. By "standard sizes" I mean the sizes of sheets adopted by the manufacturer. This standard changes as one passes from shop to shop.

No matter what the standard the paper has to be cut, and unless something more than a pair of shears is provided the task becomes very burdensome.



A TABLE FOR CUTTING DRAWING PAPER.

The sizes of sheets used where the following device is employed are 11½x16 and 16x23. These are outside dimensions. The paper is cut into sheets 12¾x17¼ and 17¼x24¼, thus giving a ⅝-inch margin for tacking.

Detail paper, tracing cloth and blueprint paper is purchased in rolls 30 inches wide, which cuts to the above sizes with no waste.

The first tool used in cutting is an ordinary hand saw. Grip the roll of paper firmly in a vise and 12¾ inches from one end begin to saw and keep sawing until you have two rolls of paper, one 12¾ inches wide, the other 17¼. By cutting the paper which is 12¾ inches wide into pieces 17¼ inches long we have the smallest size of sheet use, and from the roll 17¼ inches wide we can cut lengths 12¾ or 24½ and obtain either small or large size sheets.

The device for cutting the rolls into lengths is much more novel than the one used for dividing the roll. It is shown in the illustrations, which are sectional elevation and plan, respectively. It consists essentially of a table with a chamber at the left for holding the roll of paper. This chamber is provided with swinging cover *A*, which gives an opening sufficiently large to receive the roll. The paper is passed out through the opening between this cover and the table top and drawn along until the end reaches the graduation on the scale *B* for the required length of sheet. This scale is a yardstick inserted so that it is flush with the table top.

The brass strips *C* and *C'* are let into the table and placed about 3-32 inch apart, giving ample room for passing the blade of a pocket-knife between, thus cutting off the paper. The lip *D* on cover *A* keeps the paper from slipping back into the chamber when the sheet is cut off. The distance between the end of lip *D* and the opening between brass strips *C C'* should be at least ⅜ inch and the paper should be placed in chamber in the position shown so that the end will curl up when the sheet is cut off. This leaves the end of the paper in a convenient position for drawing out the next sheet. TIBBAB.

The Arrangement of Views on Working Drawings.

Editor American Machinist:

In your issue No. 19, page 529, Mr. John Randol offers some criticisms upon my article relating to working drawings which do not appear to have been well considered. He says my views are evidently those "of a shop man." They would be none the worse for that if it were true, but in this he is mistaken, except that I have been in close enough touch with shop men to fully realize the annoyances to which they are at times subjected without good and sufficient reason. In his opening paragraph Mr. Randol rather harshly intimates that I am not really familiar with the art of making working drawings for use in the machine shop, and states that "the whole article is based upon the assumption that it is needful and economical that the working machinist should understand the general arrangement and construction of the whole of every machine of which any detail is entrusted to him for finishing." Mr. Randol considers this an erroneous view, and I fully agree with him, and will say that the article implies no such assumption. I also entirely agree with what he says in the second and third paragraphs, and nothing which I have ever said or written can be held as intimating the contrary.

I wrote that all details should be made from the the same point of view, *if possible;* that the various plans, elevations and sections appear in detail exactly as they would in the general drawing if the balance of the structure were assumed to be transparent. Mr. Randol pronounces this to be "a wholly absurd proposition," and instances the case of a piece which appears in an oblique position. This, of course, would be drawn square with the sheet in detailing. I gave a rule to be followed, if possible—that is, possible with a reasonable degree of effort. On a general drawing an operating lever may be shown at the end of its stroke and so appear at an angle; the draftsman will nat-

urally detail it either horizontally or vertically, but that does not give him an excuse for turning it end for end or upside down. The example of the shear was not a single instance, but one of hundreds, and applies to all other machines as well. I have seen an engine detailed with its bed plate in one direction, the cylinder in just the opposite, and the piston shown crossways. The rule in question is one that is followed by experienced men, except when good reason appears for violating it. As Mr. L. O. Danse said in a recent number of the "American Machinist," the draftsman must exercise judgment; no absolutely hard and fast rules can be laid down for his guidance, or he would soon become "mechanical" in a sense quite different from that which is usually understood by the term.

To my way of thinking, Mr. Randol takes but a narrow view of the subject, if, as might be inferred from his article, he thinks that drawings are made solely for the use of the working machinists, restricting the term to mean only machine operators, and ignoring fitters, vise hands and all who work in the erecting shop. The machine parts must be assembled by someone, and that one is not usually the draftsman. The drawings, therefore, should tell the story in the plainest possible manner. The man who checks the draftsman's work has a right to be considered, and it so happens that his interest in this matter is identical with that of the fitters, the erecting shop, the various foremen and shop superintendents. In short, all who handle drawings are interested in having the general arrangement and details accord with each other, and the drawings which save the greatest amount of valuable time for those who have to do with them are the best drawings. The machine operator has no interest which conflicts with this view of the case, since the fact that the drawings are properly made need not impel him to look up more of the work than what concerns his part of it.

GERALD E. FLANAGAN.

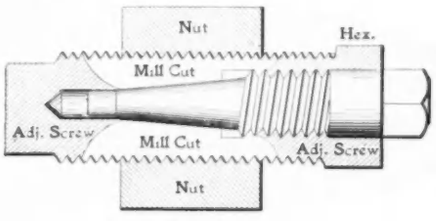


Fig. 5

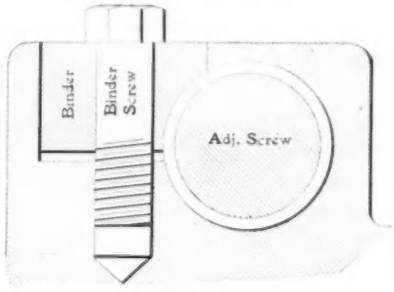


Fig. 6

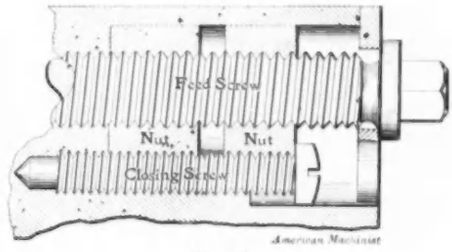


Fig. 7

CLAMPS FOR ADJUSTING SCREWS.

Adjusting Screws.

Editor American Machinist:

On page 96 Mr. F. C. Blanchard shows some adjusting screws. His screw holding and adjusting methods shown in Figs. 1, 3 and 4 are all good and all very very old, but will of course be new to some of the sprouting tyros who will presently become the directing engineers.

The neatest of all screw holdings is shown in Fig. 5—I continue Mr. Blanchard's numbering—and is very largely used in the Waltham watch factory machine-tool adjustment screws, where absolute precision must be had in connection with the least possible dimensions. This Waltham binder takes up no room at all. It consists of a taper plug having a threaded part and a squared outer end to turn it by. The adjusting screw has a conical seat to fit the taper plug, and is made expansible by cutting four sinking mill cuts in it, so that by screwing the taper plug into the adjusting screw the diameter of the adjusting screw is increased. Hand reamers by at least one well-known maker are similarly adjusted.

Fig. 6 shows the turret binder applied to adjustment screw clamping. This is substantially the same as Mr. Blanchard's Fig. 4, but takes less head room, and because the turret binder can be made of large diameter the thread bearing may be made great enough to serve as a nut closer to take out lost motion between the screw and the solid nut in which it works. I use this turret binder screw holder with great satisfaction. The binder is put in place and screwed down hard before drilling and tapping for the adjusting screw nut, thus giving all solid metal for the drilling and tapping operations. After drilling and tapping the binder is faced off on the bottom enough to give it a pinch on the screw.

Mr. Blanchard's Fig. 3, while effective and often used, is rather a barbarous affair, and should always have a distance collar placed in the cut with just clearance enough to permit pinching the screw which is to be held. If the distance collar or washer is omitted, the ordinary fool machine tender is very likely to put his muscle on the binding screw and bend the fork ends toward each other.

The late Col. Woodruff, contractor with the Pratt & Whitney Company, was, so far as I know, the originator of a very neat feed-screw nut closer and binder, shown in Fig. 7. In this arrangement the feed-screw nut seat is a plain cylindrical bore. To this bore a feed-screw nut is fitted which is long enough to cut in two, and so make the two feed-screw nuts shown in the final construction. After fitting this nut in place, the seat for the filister head closing screw is drilled and tapped in such a location that the closing screw is tapped partly into the nut and partly in the solid metal of the frame or supporting member.

After the closing screw seat is tapped the feed-screw nut is driven out and this nut is then cut in two to make two nuts and the closing screw thread in the outer nut is cleared away, so that it is not affected by the closing screw thread, but is closed towards the inner feed-screw nut by the travel of the filister head of the closing screw. The threads of the closing screw hold the inner section of the feed-screw nut in place, and, turning the closing screw with a screw driver, takes all the lost motion out of the feed-screw nut, or binds the feed screw as the operator may desire.

This is an extremely good binding arrangement. It is very easily made, easily assembled and easily disassembled, and is very strong and perfectly rigid, and the screw-driver and monkey-wrench idiot, who must forever be foremost in the good machine designer's consideration, cannot injure it, no matter how stupid he may be. It may be said to be impossible to fit a solid square thread feed-screw nut so that there is no lost motion between the threads of the nut and screw, but by use of this double nut arrangement a perfect fit can be obtained with any desired degree of friction on the feed screw. The closing screw has three functions; it pinches the feed-screw nuts together, holds the inner feed-screw nut in place endwise in the frame, and prevents the outer slidable section of the feed-screw nut from turning in its seat. This binder is suitable for both square and V-threaded screws, and is the best arrangement I know of for its purpose.

JOHN RANDOL.

A Large Micrometer Caliper—A Taper Roller Gage.

Editor American Machinist:

Enclosed find sketches of two gages, which I think will interest the readers of

the "American Machinist." The first gage was used for gaging sixteen liners for four marine engines. The outside diameters of the liners—41, 56, 77 and 108 inches—were turned for a press fit in the cylinders. There were, of course, four gages made, all like sketch. The size was taken from the cylinders with the ordinary gage made of a stick of wood with wood screws in each end for adjustment. The gage in sketch was then set for the outside diameter from this gage, enough larger being allowed to make a good press fit. As you can see from the sketch, the gages were made of ordinary iron pipe and fittings, and did not cost much. The top clamp of each gage was extended out and a hole was drilled through for a hook. From a column near the front of the lathe a rope was run up to a wooden bracket, the end of the bracket running out to the center of the lathe. The rope was run out to the end of the bracket and then down to the lathe with a hook on the end, which went through the eye in the top of the gage. The gage was then hoisted up until the adjustable screws were in line with the center of the lathe and then fastened, so that, to try the gage over the liner for size, a helper held one point on the liner on one side, while the machinist raised and lowered the gage on the other side.

The second gage was used on a lot of cast-steel rollers for battleship turrets of the "Kearsarge" type. The rollers were to go between two tracks on which the turrets revolve, and had to be as near alike as could be made, so the weight of the turret and guns would be evenly distributed. Tap-bolts—shown in the end view—hold the V-blocks in place. They were put in before the V-blocks were planed, and then the surface plate, with V-blocks in place, was put on the planer and set so that one V-block would be planed deeper than the other, and thus bring the bottom side of the taper roller parallel with the surface plate. The roller was set in the V-blocks so the distance between the inside of the flange of roller and V-blocks at the bottom was equal at each end. The V-shaped piece *E* on the top of the roller was planed on the V-side to fit the taper of the roller. It was then placed on the sample roller, which was set in the V-blocks already planed, and the top edge of the V-piece was laid off with a surface gage and planed and then scraped the distance between the flanges of the roller, and the ends of V-piece being kept equal. After the rollers were turned to size, they were placed on the V-blocks, the block under the small end of the roller being one-half the taper higher, so that the bottom of the roller would be parallel with the surface plate. Plate *E* was then placed on the roller, and the gage *F* moved along the edge of E. If there was any variation in hight or in taper, it would soon show it.

A MACHINIST.

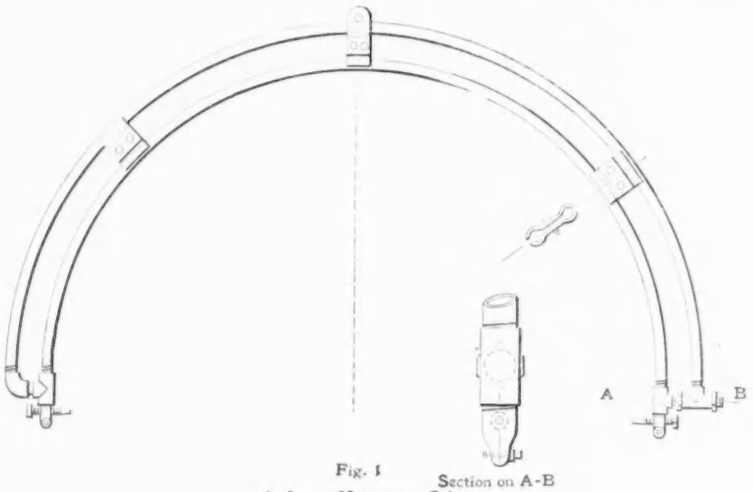
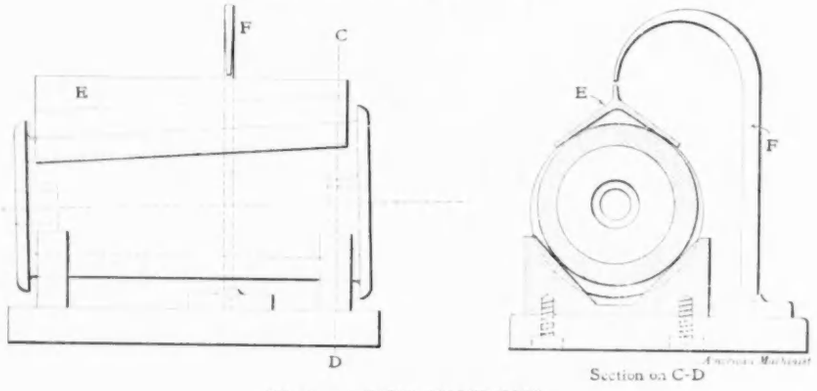


Fig. 1 Section on A-B
A Large Micrometer Caliper



Section on C-D

FIG. 2. A TAPER ROLLER GAGE.

Sawing Staves for Drums.

Editor American Machinist:

"Old Bob's" hard knocks and the startling stories of the amazing deeds of those three marvelous *multum in parvo* mechanics, on page 465, should make some of us feel ashamed of our limited stocks of divine inflatus and mechanical skill. I, being a very ordinary product of the home market, have felt badly in need of a government subsidy since reading "Bob's" letter.

It is, however, an interesting and instructive letter; but I am going to be presumptuous and differ with Robert in regard to that portion of it where he calls, what he has chosen to term, "the little bluff game put up by 'Phos Phorus,'" and endeavors to make that gentleman look and feel like a third of the American currency unit.

Our talented friend says: "The 'American Machinist' and geometry teach us that the old game of running the staves over the circular saw at an angle produces a segment of an ellipse, and not a circle; the wider the stave the greater the error." This is an axiom; but "Old Bob" is "'way off" if he intended to convey the idea that the error in the circle is so great that it makes the mode of construction, advocated by "Phos Phorus," impracticable or impossible. I don't advocate building drum or cylinder patterns in this way, but have done so lots of times, to comply with the practice of certain shops that I have been allowed to dally in for uncertain periods, and have never experienced the slightest difficulty in making the staves fit the circular heads perfectly, using no tools but the circular saw.

Building up wood drums for grinding lathes is a job that comes to me quite often in these days. These drums range in diameter from 14 to 20 inches and in length from 3 to 8 feet. The wood staves are fitted over iron pulleys, turned to the right diameter for the size of the drum to be made and set-screwed to the shaft. Two pulleys are used for the shorter drums and three for the longer. Screw holes are drilled through the rims to fasten the staves in place. The joints between the staves are of course glued and the drum is turned on its own shaft.

I make the narrow faces of the staves from 3 to 4 inches wide and concave them on the circular saw as described by "Phos Phorus." I know it's not right and that an error exists; but it's not visible to the unclothed optic, nor can it be detected by chalking the pulley rims, and I guess that ought to be near enough for all practical purposes—with all due respect for the teachings of the "American Machinist" and geometry.

Possibly "Old Bob" can suggest some

better or quicker way of staving up drums of this description; if so, he can earn the heart-felt thanks of at least one pattern-maker (who is neither a foreman nor a marvel) by doing so at his earliest convenience. "HOBO."

Punching, Forming and Cutting Die for Pipe Straps.

Editor American Machinist:

This die was made for the purpose of forming, cutting-off, and punching the holes for screws in pipe straps *X*, making a completed strap at each stroke of the press, and it was made adjustable to take punches for four different sizes of pipe, the feet of the strap being the same in all four, and having the same size holes. The punch shown is for 1½-inch iron pipe, and the other sizes for which the punches are made are 1¼, 1 and ½-inch pipe.

The blocks *F F* are moved toward each other, and shims of the proper thickness are placed between them, and the screws *M* are for the adjustment of the dies to suit the various punches. They are then locked to the bed of the die by the bolts shown in the plan. The alinement of the die is fixed by the keys or tongues *K*, which are dowelled to the blocks, and which slide in the groove *G* milled in the bed. The bed is of cast iron and has grooves milled in the bottom to receive the heads of the bolts, and has also two stayblocks keyed to it and fastened by screws. The screws *M M* pass through these stayblocks and butt against the die or shim, as the case may be, and overcome any tendency of the dies to separate while the work is being forced in.

The stop *I* is used for three sizes only, and is removed for the punch represented, which is the largest size, and another stop substituted.

The drawing blocks *D* are of tool steel and hardened, and are held up against the drawing strain by twelve springs in each, holes being drilled in the bottoms of the blocks to receive them. These springs are wound on an arbor the diameter of the spring wire; they are made of drill rod and are tempered after winding. They work very nicely in this die, since the motion they must overcome is only 1-16 inch.

The drawing blocks are held in position by the pins *E E*, which also serve as punches to punch out the blanks for the holes in the straps. The body of the punch *A* is of machinery steel, and the cutting punches *B B* are fastened to it with screws and pins. These punches also act as dies to receive the punches *E E*. The blanks made by *E E* are immediately ejected by the plungers *C C*, acted on by powerful springs above them, which have their tension adjusted by the screws *L L*. The extensions *X X* are intended to prevent the metal operated upon from scraping over the cutting edges while drawing into the die. As a matter of fact, however, this scraping does occur to a small extent, but not enough to hurt either the work or the tool. The extensions are also convenient places to fasten the punches to the body. At *W* is shown a bottom view of one of the punches. The material used is soft brass in ribbon form, and of the right width; its thickness is No. 14, Brown & Sharpe gage.

J. R. GORDON.

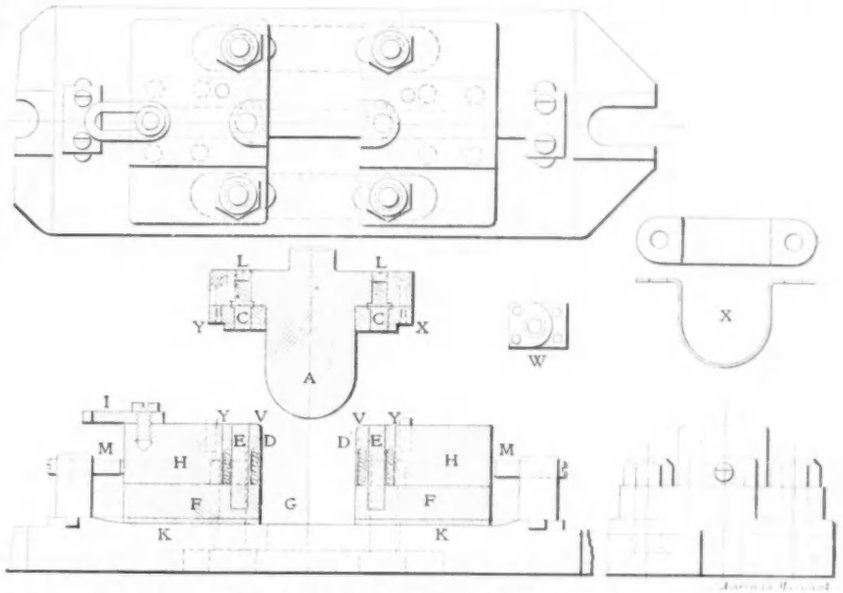
The Location of the Air Receiver.

Editor American Machinist:

The pressure of other matters has necessarily deferred the preparation of these further remarks anent the most suitable location for the compressed air receiver, in response to the exploitation of the subject by Mr. Frank Richards on page 440.

A receiver that attains a temperature of 400 degrees from its contents would seem manifestly too small for any of its legitimate functions, and the use of proper oil will explode the explosion bugbear. The freezing of exhaust ports in compressed air shop installations has become a thing of the past, where proper observance of individual conditions is evident. This and other compressed air maladies are usually traceable to the purchase of pneumatic equipment like shelf hardware, and its installation by the user without the advice or assistance of compressor-builder or pneumatic-tool manufacturer, a trade condition happily less often observed with the advancing use of pneumatic machinery.

W. P. PRESSINGER.



PIPE STRAP PUNCHING AND FORMING DIE.

It is an indisputable fact that a cool surrounding atmosphere is imperatively necessary if the receiver is to serve as a condenser of moisture or settling tank in addition to its other functions, and in the majority of installations, embracing outdoor work or covering extensive area, there can be no question as to the importance of eliminating moisture from the air prior to consumption. My recommendation in the paper recently presented before the New York Railroad Club that the receiver be placed in a warm location was based upon the assumption that the air would be used in the immediate vicinity of the receiver in a properly heated shop. Under such conditions moisture present in the air exists as a vapor, and as such presents no objectionable features in its application to pneumatic-tool operation.

A receiver placed close to a steam boiler or other warm location supplying air to tools working nearby serves the purpose of a reheater, and if, as is claimed, the air does not tarry long enough in the receiver to derive reheating benefit, then let us abandon reheaters, for the passage of the air through them is equally rapid.

His Teeth are Variable.

Editor American Machinist:

Don't be too sure about those teeth. That Englishman struck Cleveland about April 1. He has several sets of false teeth. We had been posted to look out for an Englishman with his front teeth nearly all gold. We suspected the fellow and looked for the gold teeth, but saw only the two tusks you have described, and so tipped him to a small amount to help him out of financial difficulties.

Your description is perfect, both as to appearance and characteristics, telephone methods and all. Look out for the fellow, but don't bank on the teeth, as he has several sets of false ones, as well as many names.

J. D. COX.

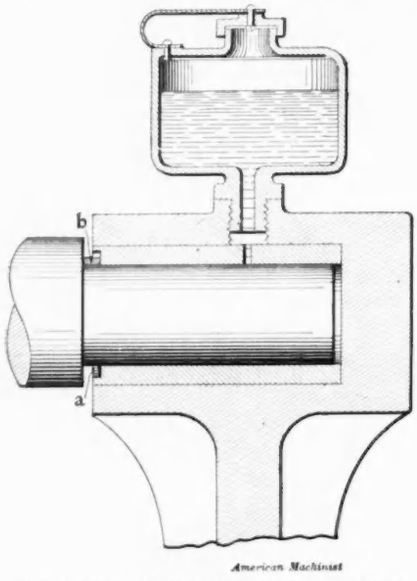
A meeting of the Get-Together Club was held the evening of May 23 in Brooklyn, N. Y. The attendance numbered 225. The topic was "Social and Industrial Betterment in the South." There were valuable addresses by Rev. Dr. Lyman Abbott, Prof. Frissell, principal of Hampton Institute; Robert C. Ogden, John Wanamaker and others.

Some New Things.

LUBRICATING BEARINGS EXPOSED TO DUST.

The accompanying illustration is from a United States patent recently issued to Thomas A. Edison. The specification of the patent, given below, describes the invention, which, it will be seen, is one of the simplest, in a clear and interesting way:

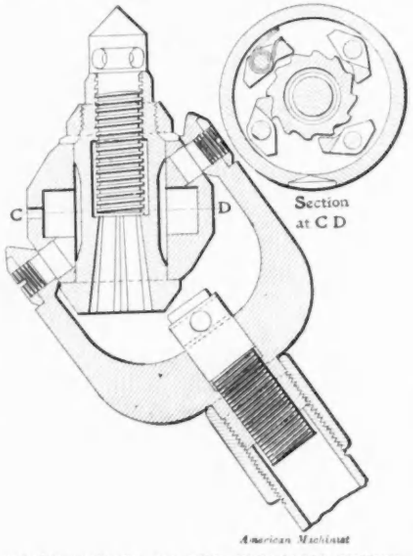
"In my mill for pulverizing, screening and concentrating iron ore I have found great difficulty in lubricating the journal bearings of the machinery employed, arising from the presence of dust with which the air is surcharged. I have overcome the difficulty by the production of an oiler which is dependent for its successful operation upon the presence of dust. This I accomplish by leaving the bearing open at one or both ends, the escape of the oil being prevented by the formation of a dust-cap around the opening and by providing a device which acts



LUBRICATING BEARINGS EXPOSED TO DUST.

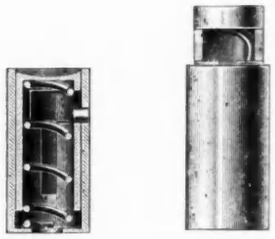
periodically to detach the dust-cap and allow the exhausted oil to escape from the bearing and a fresh supply of oil to take its place before the dust-cap is re-formed. This device for effecting the periodic detaching of the dust-cap is of very simple construction, and consists merely of a pin attached to the shaft and moving in a groove in which the open end of the bearing terminates. This groove becomes filled with dust, forming the dust-cap, which prevents the escape of the oil from the bearing. The pin traveling through this dust mixes the oil with it, and the mixture becomes first thick, then ropy, and then crumbly and falls out of the groove. The dust-cap begins at once to re-form; but before the escape of oil from the bearing is materially checked the exhausted oil has run out of the bearing and a fresh supply from the oil-cup has taken its place. This means for lubricating journal bearings is applicable to all kinds of bearings located in an atmosphere charged with dust—to those that are stationary as well as to traveling bearings on conveyors or the like. The journal may be closed at one end, the dust-cap being formed only at the other end, or the journal may run through the bearing and the dust-cap be formed at each end. The oil is supplied from a suitable cup attached midway of the bearing or at the closed end. I have found this means of oiling bearings exceedingly effective, not only overcoming the difficulties arising from the presence of dust, but utilizing that material to effect an automatic and periodic renewal of the oil in the bearing, thus enabling the oil to do its work in the most effective manner."

In the cut, *a* is the groove referred to and *b* is the revolving pin attached to the shaft. From the description it would seem that the device could only operate as described where there was much dust and the rotation slow.



IMPROVEMENTS ON THE WILLIAMS UNIVERSAL RATCHET DRILL.

It will be remembered by our readers that we fully illustrated and described the Williams universal ratchet drill just two years ago (June 8, 1899). This interesting tool embodied a number of interesting improvements upon the time-honored ratchet drill, the essential practical feature being that the drill could be rotated by reciprocating the handle in any direction instead of, as previously, in a plane at right angles to the drill axis. The drill has found appreciation and extensive employment, and the designers and makers have found ways and means of improving it. The cut shows in section the latest drill. This is known as size No. 4. The total length of the central portion or body from the face of the drill socket to the end of the feed screw is but 4 inches, and the largest diameter is 3 inches; so that a hole may be drilled to 1½ inches from any perpendicular obstruction. In the drill first shown the trunnions for the lever were solid on the body of the drill, and the yoke for the hand lever was made in halves to slip over them and clamp together. In this drill the yoke is solid and the trunnion pins are screwed into it from the inside and secured by check nuts in a counterbore on the outside. The trunnion pins are put in before the central spindle is in position, and as the handle swings these pins turn in the holes in the body. The spindle shown has a taper square hole; an interchangeable spindle is made with a Morse taper socket. The handle of the drill is of ¾-inch wrought pipe; so that if for any purpose a longer or a shorter handle is required, a piece of pipe of the proper length and with a standard pipe thread on the end will fit in place of the regular handle. The ratchet pawls, it will be noticed, are now made with tails which prevent them from swinging in too far and causing inconvenience when inserting the spindle. The drill weighs 4 pounds. It is made by the Waterbury Tool Company, Waterbury, Conn.

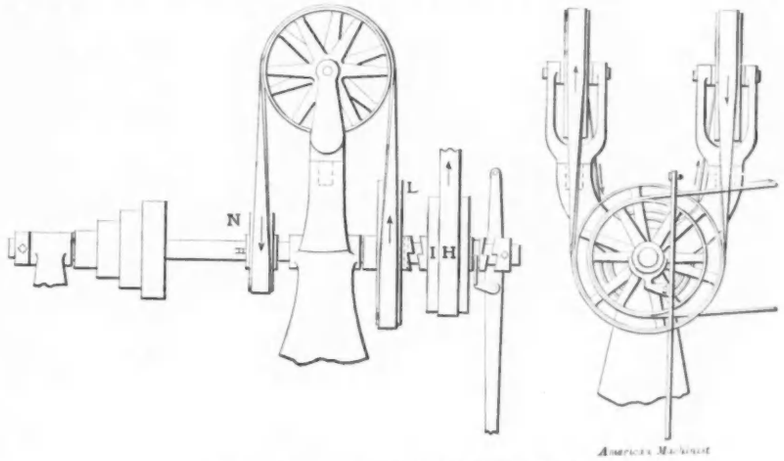


OILER FOR LOOSE PULLEY.

Most of our readers know the difficulty of properly lubricating parts of machinery where the oil hole must be in the moving part especially, such, for instance, as cone pulleys of lathes, etc. Where tubes are inserted for this purpose closed by small screws at the top, these screws usually are lost within a short time, and the oil holes are then left open or plugged with something that must be dug out whenever oiling is to be done. Most of our friends who construct machinery will therefore be glad to know that an oil cup has been perfected which seems to obviate these difficulties completely. It is shown, in section, closed and an outside view, open, in the accompanying engravings. It consists of a tube which is driven into a hole drilled to receive it in the pulley; inside of this tube being another one which fits freely and which is closed at the top and has a slot for screwdriver. A half-turn of this inner tube with the screwdriver turns it to a position where the pin releases it and allows a spring to open it up as shown in the second view. Oil can then be introduced and a downward pressure and half a turn of the tube with the screwdriver again locks it in place. The plug cannot in this way become loose or be lost. It is always in place and is decidedly superior to the ordinary arrangement. It is made by the Winkley Company, of Hartford, Conn.

A REVERSIBLE TWO-SPEED COUNTERSHAFT.

The accompanying cut, from a recent patent, shows a countershaft for a screw cutting lathe, or other machine of similar requirements, in which the shaft is made to run in either direction and at a higher speed when reversed with a single driving belt and a single shipper lever. *H* is the driving belt and *I* the driven pulley. This pulley turns loose on the shaft, and is shifted endwise on the shaft by the shipper lever to engage the clutch on either side. When the clutch on the right-hand side is engaged the shaft turns in the same direction as the pulley and at the same speed. Pulley *L* turns loose on the shaft, and the clutch jaws at the side of it are integral with it. When the shipper is thrown to the left and this clutch is engaged, the motion of the pulley is transmitted by the belt over the idlers to the smaller pulley *N*, which of course turns in the opposite direction and at a higher speed inversely proportioned to the reduced diameter, and, as this pulley is secured to the shaft, that turns with it. This device might be serviceable in some cases where the backing belt is still employed on the screw-cutting lathe. The practical objection to it is in the positive clutches, which would strike so hard when engaging. It would certainly be necessary to employ conical or other friction clutches instead of them.



REVERSIBLE TWO-SPEED COUNTERSHAFT.

It is to be remembered that this cut is from a Patent Office drawing, and while it shows the principle clearly enough, it also shows that the patent attorney and the Patent Office examiners perhaps never saw a lathe in operation. The cone is reversed, and the clutches and the belt movements all assume that the lathe is to run faster when cutting than backing.

American Foundrymen's Association

The annual convention of the American Foundrymen's Association will be held in Buffalo, June 4, 5 and 6. An interesting list of papers and addresses is provided and the arrangements include visits to the Pan-American Exposition, Niagara Falls, etc., so that apparently little time will be left for the discussions, which are usually a prominent feature of these meetings. The discussions may be had later in the technical journals.

Examination for Foundry Foreman.

The Chief Examiner of the New York State Civil Service Commission at Albany announces among examinations to be held in various cities of the State, about June 15, one for foreman of foundry at the State prisons at $5 a day. The examination will comprise practical questions and experience and will be open to citizens of the State at least 21 years of age. Applications must be filed by noon, June 10. Blanks may be obtained by addressing the Chief Examiner.

The Standard Tool Company, of Athol, Mass., writes us that it has decided to adopt the nine-hour day in its shop, commencing June 1, although there has been no demand or request from the men. The shops are, however, very busy, and it is expected that instead of actually working nine hours per day they will work ten, as at present, and be paid extra for the overtime.

Personal.

H. G. Steinbrenner, who for four years has been connected with the Brown Hoisting Machinery Company, is now superintendent of the Grant Tool Company, Franklin, Pa.

D'Arcy W. Roper, an engineer, who has been in Europe a good deal representing the Buffalo Forge Company, and who installed the heating and ventilating system in the shops of the German Niles Works, which we are now illustrating, has gone to London to open and take charge of a permanent headquarters of the Buffalo company there.

Rather than permanently abandon his home at Berlin, Conn., and go to Pittsburgh, Pa., to live, Charles M. Jarvis, formerly president of the Berlin Iron Bridge Company, which was merged in the American Bridge Company, has resigned his office with the latter. He will retain his financial interest in the United States Steel Corporation.

Obituary.

Gilbert M. McCauley, general manager of the Central Iron Works, Harrisburg, died suddenly, May 25, sixty years old.

George W. M. Reed, vice-president and treasurer of the Pratt & Whitney Company, died at Tariffville, Conn., May 22, sixty years old.

Job. H. Jackson, president of the Jackson & Sharp Car Building Company, died at Wilmington, Del., May 23, sixty-eight years old. Mr. Jackson was one of the founders of the business, and had spent thirty-eight years in building it up.

Charles H. Ashburner, ex-president of the Abbott Iron Company, died at Baltimore, May 22, seventy-four years old. Born in Philadelphia, he went to Baltimore in 1850, entering the employ of the Ashland Iron Company, and ten years later becoming a member of the firm of Brooks Brothers & Co. After the civil war he was with Horace Abbott & Son, afterwards the Abbott Iron Company, rising to the presidency of the company. Later he was treasurer of the Pottstown Iron Company, until his retirement three years ago.

New Corporations.

General Tunnel Engineering Co., of New York city; capital, $100,000. Directors: W. H. Knight, F. M. Laude and D. J. Newlans.

The Wheeling Can Co. has been incorporated under West Virginia laws. It is understood that it will be a competitor of the American Can Co.

Sectional Pneumatic Tire Co., of Binghamton, N. Y.; capital, $50,000. Directors: E. C. Inderlied, B. A. Baumann and F. J. Baumann, of Binghamton.

The H. H. Manufacturing Co., of New York City; to manufacture metal goods; capital, $100,000. Directors: Bernard Hofeld, Yonkers; W. N. Head, Brooklyn; Frederick Hofeld, New York city.

Rogers Locomotive Works Co.; principal office, Paterson, N. J.; object, manufacturing locomotives, etc.; capital, $125,000. Incorporators: Charles A. Stover, Frank A. Branda and Thomas R. Evans.

Gasper Motor Co.; principal office, 185 Montgomery street, Jersey City, N. J.; object, manufacturing automobiles; capital, $50,000. Incorporators: John W. Avery, Horace G. C. Thornton, George R. Allison.

Loew Filter & Manufacturing Co.; principal office, Cranford, N. J.; object, manufacturing tools, hardware, etc.; capital, $20,000. Incorporators: Stephen J. Cox, Herman Meyer and Stephen S. Newton.

United States Drilling Co.; principal office, 765 Broad street, Newark, N. J.; object, manufacturing drilling apparatus; capital, $10,000. Incorporators: George F. Maguire, Charles W. Deyo and N. F. Giffin.

Dithridge Steel Car Co.; principal office, 76 Montgomery street, Jersey City, N. J.; object, manufacturing cars; capital, $200,000. Incorporators: Edward L. Dithridge, Charles W. Morrison and Robert L. Walterbeck.

United States Electric Manufacturing Co.; principal office, New Jersey Corporation Guarantee & Trust Co. Building, Camden, N. J.; object, manufacturing electrical devices; capital, $500,000. Incorporators: W. H. Miller, John W. Brown, J. E. Beyers.

Snider's Turret Hydrant & Nozzle Co.; principal office, 81 Montgomery street, Jersey City, N. J.; object, manufacturing hydrants, etc.; capital, $250,000. Incorporators: Chas. A. Snider, George W. Morrow, Andrew J. Prophy, Edw. D. Conn, Frank S. Potter.

Wm. H. Rogers Corporation; principal office, 132 North avenue, Plainfield, N. J.; object, manufacturing silverware; capital, $100,000. Incorporators: Wm. H. Rogers, Eugenia L. Babcock, Joseph A. Hubbard, Howard P. Reynolds and John P. Mosher.

Independent Tin Can Company, incorporated in New Jersey; to manufacture tin cans; capital, $1,000,000. Incorporators: Frank L. Montague, of New York; Benjamin Adriante, of Brooklyn; Fred. W. Wentworth, of Paterson, and Alfred Gartner, of Paterson.

The De Laval Steam Turbine Company (capital, $1,000,000) was incorporated in New Jersey May 8, to manufacture steam turbines, dynamos and other apparatus. The company has control of a patent for steam turbines and is building a plant in Trenton.

Pennsylvania Steel Co.; principal office, New Jersey Corporation Guarantee & Trust Co. Building, Camden, N. J.; object, manufacturing steel; capital, $50,000,000. Incorporators: Effingham B. Morris, Edgar C. Felton and Luther Bent. Mr. Felton has been elected president.

United States Tire Inflator Co.; principal office, the Corporation Trust Co. Building, Jersey City, N. J.; object, manufacturing automatic bicycle pumps, etc.; capital, $125,000. Incorporators: Ansley D. White, John Laughlin, Maurice B. Pitch, Thomas W. Symons, Rowell Park.

The Marine Fire Extinguishing Co. was incorporated in New Jersey May 13 with a capital stock of $2,000,000. The company is to operate under Febiger's patent. The incorporators are Henry B. Febiger, Harry Woodon, R. B. Jones, Wm. C. Freeman and W. C. Wiederselm.

Whitney Car Wheel Co.; principal office, 320 Market street, Camden, N. J.; object, manufacturing and selling car wheels; capital, $150,000. Incorporators: Thomas B. Whitney, Wm. S. Darnell, Francis Shumann, John Thomas, T. Fernley Brooks, J. Lancaster Daily and others.

The Tula Iron & Steel Works & Manufacturing Co.: to mine ore and to manufacture iron and steel; capital, $2,500,000. Incorporators: M. R. Burnham and B. F. Burnham, of Erterreria de Tula, Mexico; E. L. Imhaff, of Pittsburgh, and Robert L. Lawrence and Francis McGee, of Jersey City.

New Catalogs.

The Western Electric Company, Chicago and New York, has sent us a pamphlet relating to its series enclosed alternating arc lighting system. It is 8x10¾ inches.

We have received a pamphlet (5¼x7¾ inches), attractively illustrated with views of constructions in which the cement of the Chicago (Ill.) Portland Cement Company was employed.

The Joseph Dixon Crucible Company, Jersey City, N. J., sends us a pamphlet containing a price list of perfected graphite brushes for motors, dynamos and generators. It is 3¼x6 inches.

We have received a catalog showing some of the machines made by the Royersford Foundry & Machine Company, Royersford, Pa., viz.: an improved single-end shear, improved single-end punch and Nos. 1, 2 and 3 combined punch and shearing machines. The pamphlet is of standard size, 6x9 inches.

The Dodge Manufacturing Company, Mishawaka, Ind., has issued a neat little pamphlet (4⅛x6 inches) concerning its iron split pulleys with standardized bores and system of interchangeable bushing centers. The different sizes of pulleys, both split and solid, are extensively tabulated and priced, a code word being given for each.

The Garvin Machine Company, Spring and Varick streets, New York city, has published a small pamphlet on its friction countershafts and accessories. All the friction pulleys are turned, bored, faced and reamed on the company's No. 24 chucking lathe, which finishes a pulley complete at one chucking. A pulley polisher is also shown. The pamphlet is 6x3⅜ inches.

J. E. Snyder, Worcester, Mass., has published a 1901 catalog of standard upright drilling machines. The different sizes shown here, running up to 36 inches, form quite an extensive line of drill presses. There is among others a new pattern back-geared sliding-head quick-return post drill, 20-inch and 59-inch combined. The catalog is of standard size, 6x9 inches.

The George V. Cresson Company, Philadel-

(*Continued on next page.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 24.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Mfg.plants,space,powers,lands. A.Ela,Boston.

Barnes lathe, No. 6, 13x45, fine condition, very little used. Address S. K., care AM. M.

Wanted—6 ft. or 8 ft. boring mill, in good condition. Materne Mfg. Co., St. Louis, Mo.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Wanted—Patternmaker's second-hand bandsaw, in good condition. Box 127, AM. MACH.

See Presses, Space 45, S. E. cor. Machy. Hall, Buffalo. Ferracute Machine Co., Bridgeton, N. J.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Modern machine shop wants specialty to manufacture as side line. Address F. G. S., care AMERICAN MACHINIST.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

We do all kinds of light experimental model and special machine work; fair prices; satisfaction guaranteed. The Alcorn Machine Co., Waltham, Mass.

Wanted—Set of working drawings for single frame steam hammer, 4 in. cylinder, 16 in. stroke; state price and particulars. Address Box 153, AMERICAN MACHINIST.

Want to correspond with parties having well-equipped machine shop, to manufacture line of patented machine tools. Address "Machine Tools," care AMERICAN MACHINIST.

Party desirous of retiring from well-established, paying machinery business invites correspondence; has controlling interest; will require $65,000. Address C. S. G., Box 103, Evanston, Ill.

For Sale—A1 condition, American gas case hard. furnace, No. 2½, 14x38, in., American No. 1 press blower; cost $250; will sell $125. The Durbrow & Hearns Mfg. Co., 8 Wooster st., New York.

Mechanical engineer, patentee well-known machinery and apparatus, 15 years' business experience, wishes Philadelphia agency for responsible company; good references. "Grant," care AMERICAN MACHINIST.

Wanted—Space, 1,000 feet, with power, good light, suitable for medium weight machine tools; cleanly building, within 20 miles of City Hall, New York; give full particulars and rental. Address Box 126, AMER. MACH.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced draftsman wants position. P. G., care AMERICAN MACHINIST.

Position wanted as foundry foreman; 8 years' experience as general foreman. Box 166, AMERICAN MACHINIST.

Civil engineer, with several years' experience on railroad building, wants position. Box 163, AMERICAN MACHINIST.

Position by machinist and toolmaker; vise or machine work; age 40. Brooklyn, N. Y. Box 161, AMERICAN MACHINIST.

Competent young draftsman would like temporary position; will go anywhere. Address Box 165, AMERICAN MACHINIST.

Position wanted by able designer of automatic and special machinery; inventive, reliable. Box 167, AMERICAN MACHINIST.

Wanted—Responsible positions for competent men of mechanical experience. Address James Brady, 220 Broadway, New York.

Wanted—Position as superintendent of machine shop, by man of 12 years' experience as such; 36 years old and with best of references. Box 168, AMERICAN MACHINIST.

Mechanical engineer, a practical mechanic, experienced in organizing and superintending manufactures, is open for position; first-class references. Address Box 123, AM. MACH.

Mechanical engineer, practical, competent, wants to change; specialties, printing machinery, hydraulic machinery and gas and gasoline engines. Address Box 159, AM. M.

First-class mechanical draftsman, 14 years' experience, Corliss, Meyer valve engines, air compressor and heavy sawmill work, wants situation from June 1. Box 131, AM. MACH.

Situation as superintendent or mechanical engineer by Stevens graduate, age 37; specialties, gasoline automobile engines, tools for the manufacture of cash registers, typewriters, etc. Box 164, AMERICAN MACHINIST.

All-round machinist, diemaker, draftsman, 15 years' experience in light and fine work, wants steady position where ability and technical education are required; wages no object to commence. Box 157, AMER. MACH.

Designing draftsman, 17 years' experience on marine and stationary engines, special tools and jigs; experienced, reliable and systematic in charge of office; Eastern States preferred. Box 142, AMERICAN MACHINIST.

Superintendent of large engine shop desires a change; will take Corliss or high-speed engine shop or machine-tool shop; age about 36; wants no "excellent opportunity," but good, hard work and pay to match. Address Box 158, AMERICAN MACHINIST.

Position wanted, by a traveling salesman, with a firm building a line of machine tools or a specialty; practical machine tool salesman; has trade all over the United States; is a practical mechanic and posted on up-to-date methods. Address Box 169, AM. MACH.

I have a first-class outfit of tools for small shop; large experience designing and building special machinery; would like to engage on salary with responsible party who requires the services of first-class man on experimental work; will furnish the above equipment. Address Box 162, AMERICAN MACHINIST.

Constructing engineer and architect, graduate ('26), 6 years' experience in general construction, buildings, structural and mechanical work, reliable draftsman and computer, desires permanent position with a company who requires the services of an experienced man in Mexico; speaks Spanish. Box 160, AMERICAN MACHINIST.

Superintendent, at present in charge of